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rm -rf SHA-1: Algorithm Rolls En Masse

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2021-06-14

Background

- Over 50 million resource records pre-DNSSEC
- Started DNSSEC operations in 2008
- NSEC3 with Opt Out, Algorithm 7 (RSASHA1-NSEC3-SHA1)
- Type 1 and 2 DS records
- Hash Iterations = 1, static salt, next KSK pre-publish

Driving Factors

Scope

While removing risk of using SHA-1 was the impetus behind this project, we took this opportunity to also:

- **Examine original DNSSEC implementation choices**
- **Reassess: does what made sense then still make sense now?**
- **Evaluate signer capabilities with newer algorithms**

Zones In Scope

- **209 TLDs**
- **208 nic.$TLD zones, second level and sub-zones**
- **417 zones total**

Bonus Challenges

- **Many TLDs were *also* mid-KSK roll**
- **Many Customers are the IANA Administrative contact**
- **ICANN knocking on our door**
- **Tools starting to warn about SHA-1 (DNSViz, etc.)**

Research

Learned from others' strife

With ***MANY*** thanks to all:

- DNSSEC Algorithm Roll-over | RIPE Labs
- Keep 'm rolling: monitoring .se's DNSSEC algorithm rollover

Lab Testing

- **Algorithm tests**
  - SHA-256 ran without issues
  - ECDSA took too long for production signing
- **Other testing:**
  - Hash iteration increase to 100
  - Stop KSK pre-publish
  - Dropping DS type 1
  - RFC 6781, Section 4.1.4, conservative
  - Signer operations at each stage

Approach

Focus on Education and Notification

- Account Managers: KSK & algorithm roll processes, timelines
- Customers: what we're doing, and why
- IANA: Flood Warning

- **Tracking in Notion!**
  - Zones in table, with current status
  - Kanban and Gantt chart views

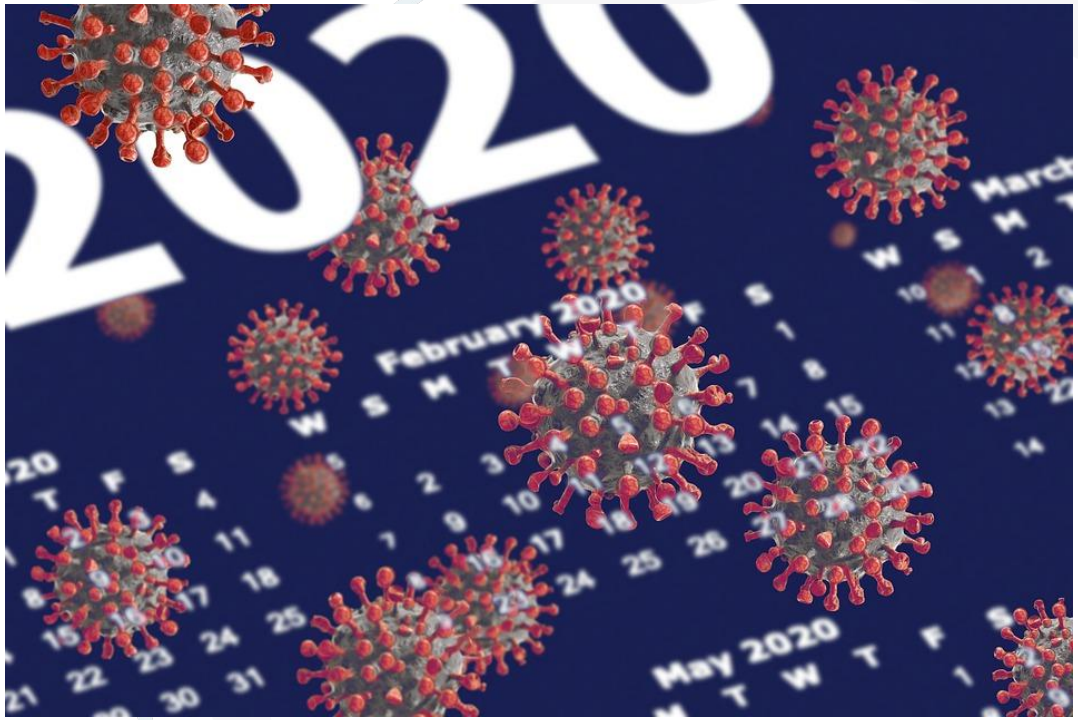
Zone Batches

For a given zone, finish KSK rolls, then proceed directly into algorithm rolls.

- **TLD Batches**
  - Proof of Concept (small subset of Afilias zones)
  - Afilias
  - PIR
  - newTLDs
  - ccTLDs
  - Australia
- **nic.$TLD batches in parallel with parent zones**

Away We Go!

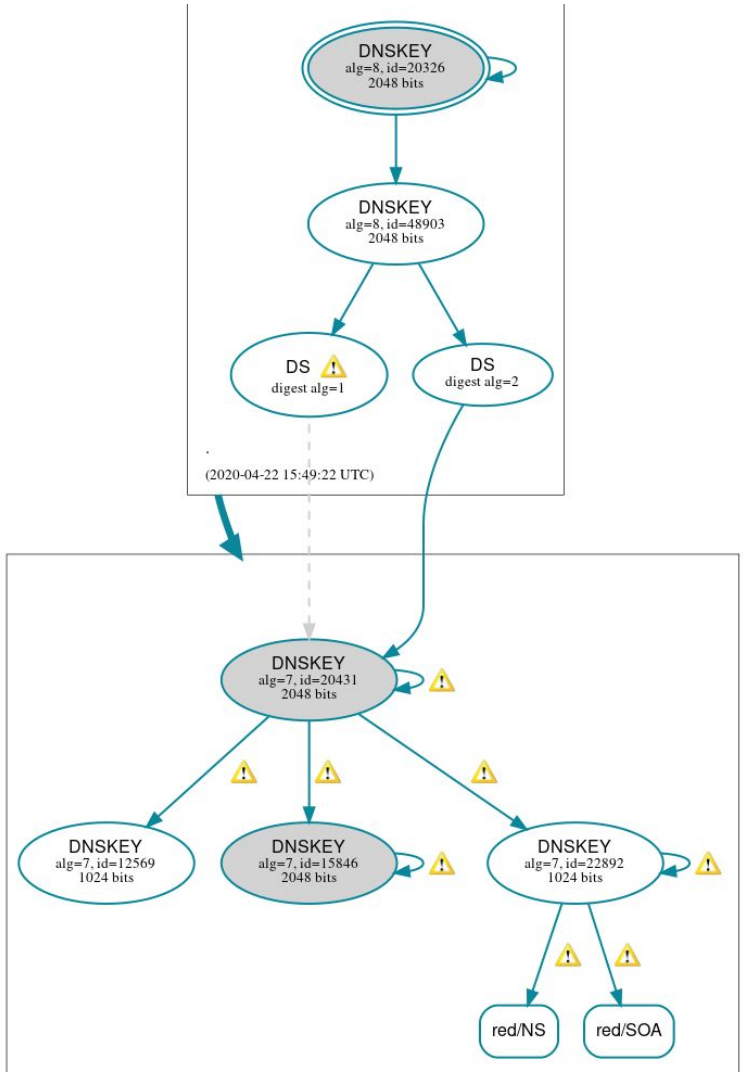
- Process start on Batch 1: 31 Aug 2020
- Most zones completed process in about 54 days
  - Each zone required 1 or 2 RZM requests
  - Re-signs on 1, 9, 17, 25 of each month
  - Most relevant TTLs were 86,400
- Current status: 416 / 417 completed
  - last TLD is finishing first KSK roll
- Expected finish: 30 Jun 2021

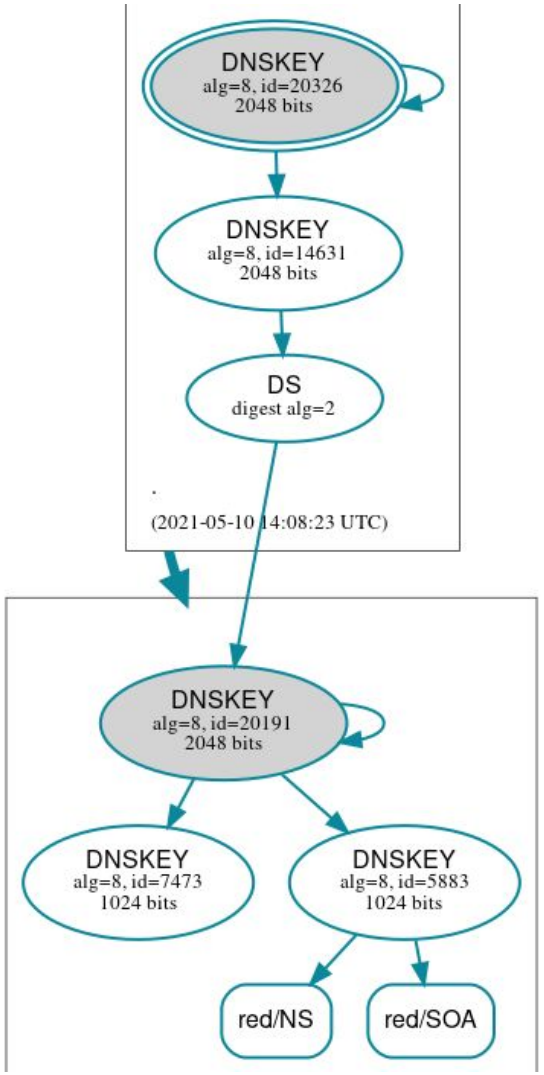


Results

- All zones now on algorithm 8
- Single DS, digest type 2
- Salt changed
- Hash iterations ultimately reduced to 10
- KSK pre-publish removed
- ZSK no longer signing DNSKEY RRSet

Before and After - red TLD



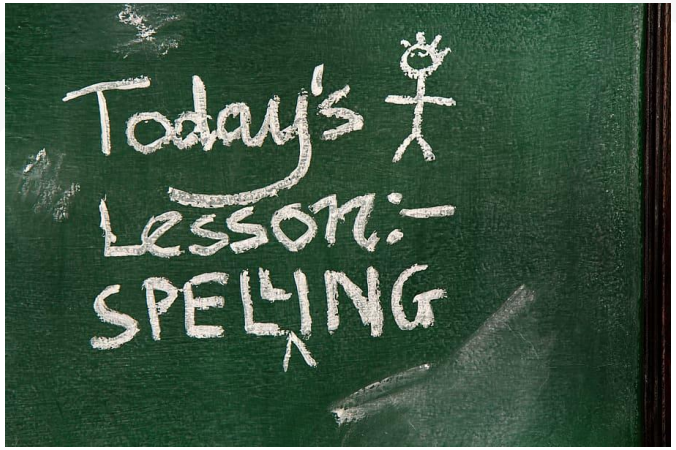


Challenges

- One zone had some signatures drop for short period of time
  - Signer bug triggered by configuration change
- “Auto-manual” RZM changes
  - Scripts to generate request data, check request before lodging, confirmation emails
  - Manual Q/C after each step, Notion updates
  - Couple of “odd” RZM process states - self-cleared?
- Delays waiting for ROs to confirm RZM requests
  - Some needed contact changes, “letterhead” style
- Plus something about a global pandemic...

Recommendations / Lessons Learned

- Keep IANA contacts current!
  - Role accounts, with group email addresses
- Watch timings carefully
  - Ensure you leave enough time between steps (4x TTL)
  - Know which TTLs affect which steps
- Communications key
  - Inform everyone impacted - no avoidable surprises
- Know your systems limitations
  - Lab test ***every*** step



Shoutouts

Special thanks to the following:

- Carl Clements (Afilias): he did the real work!
- Joe Abley, Suzanne Woolf (PIR): recommendations and advice
- George Sarkisyan and Selina Harrington (IANA/PTI): troopers through all of these changes!

Thank You - Questions?

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