DNSSEC security without maintenance

... with the right software and registry

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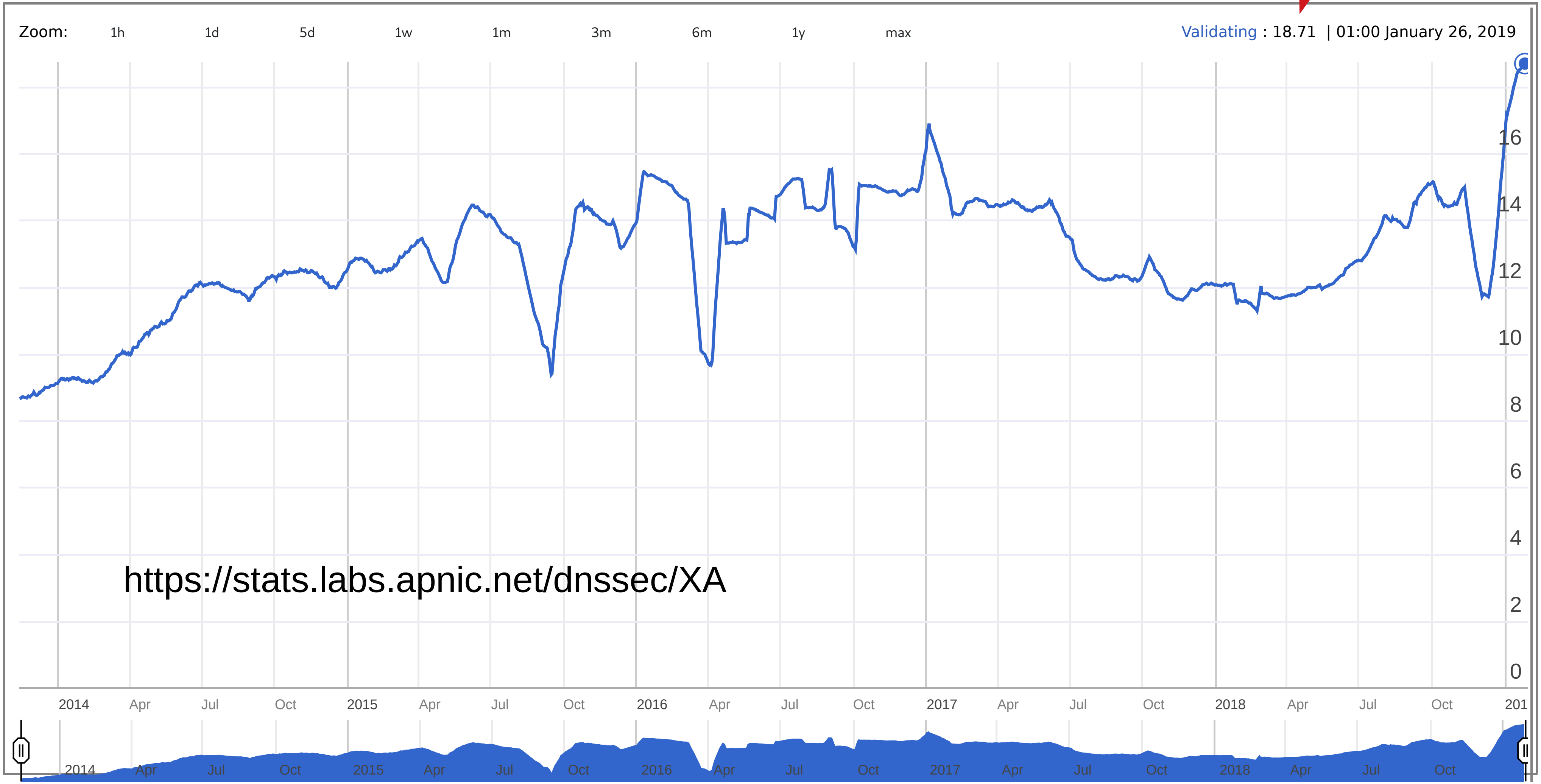
KNOT DNS

CZ.NIC | CZ DOMAIN REGISTRY

DNSSEC? Who cares?

~ 19 %

Use of DNSSEC Validation for World (XA)

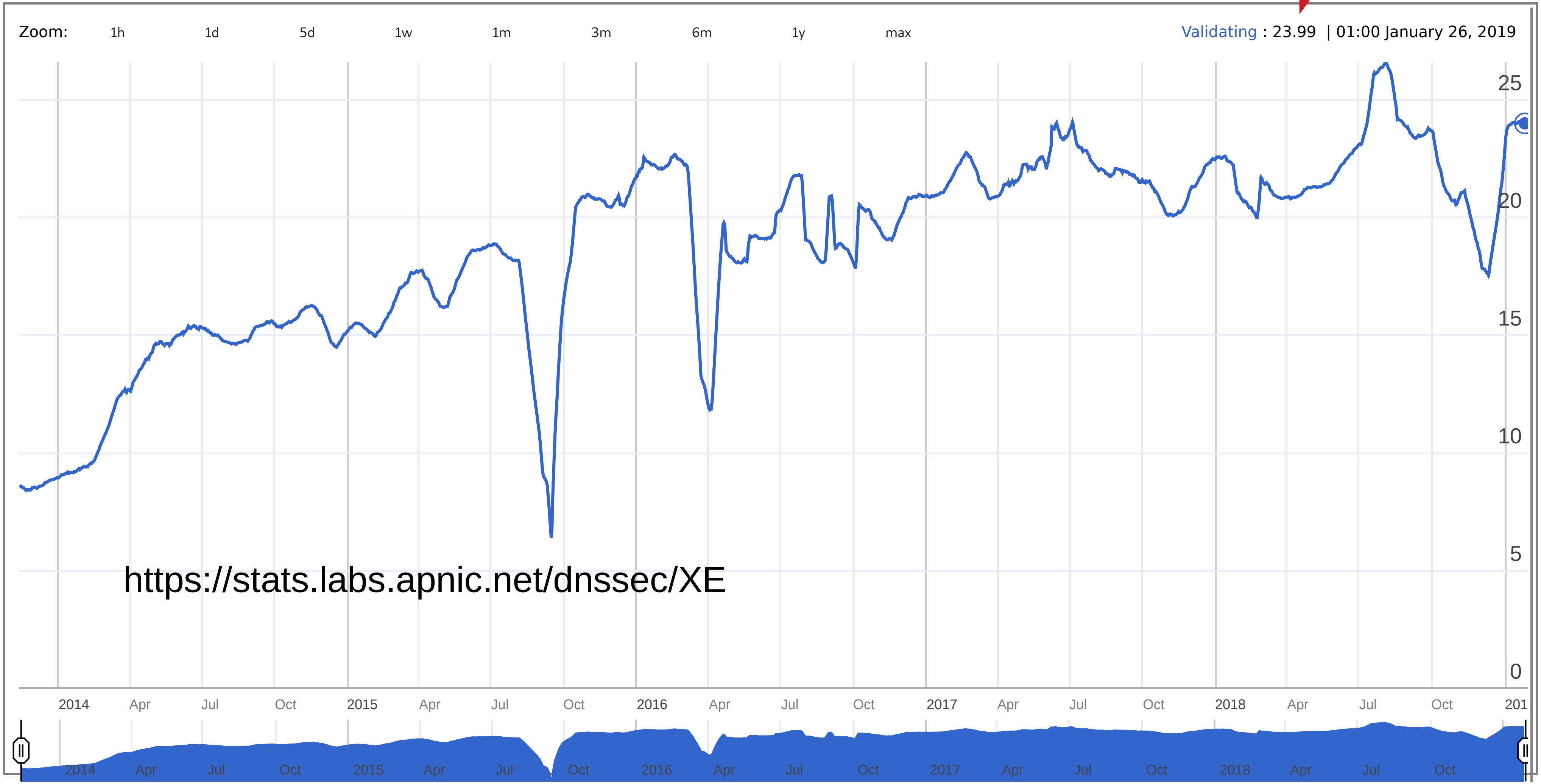


https://stats.labs.apnic.net/dnssec/XA

DNSSEC? Who cares in Europe?

~ 24 %

Use of DNSSEC Validation for Europe (XE)



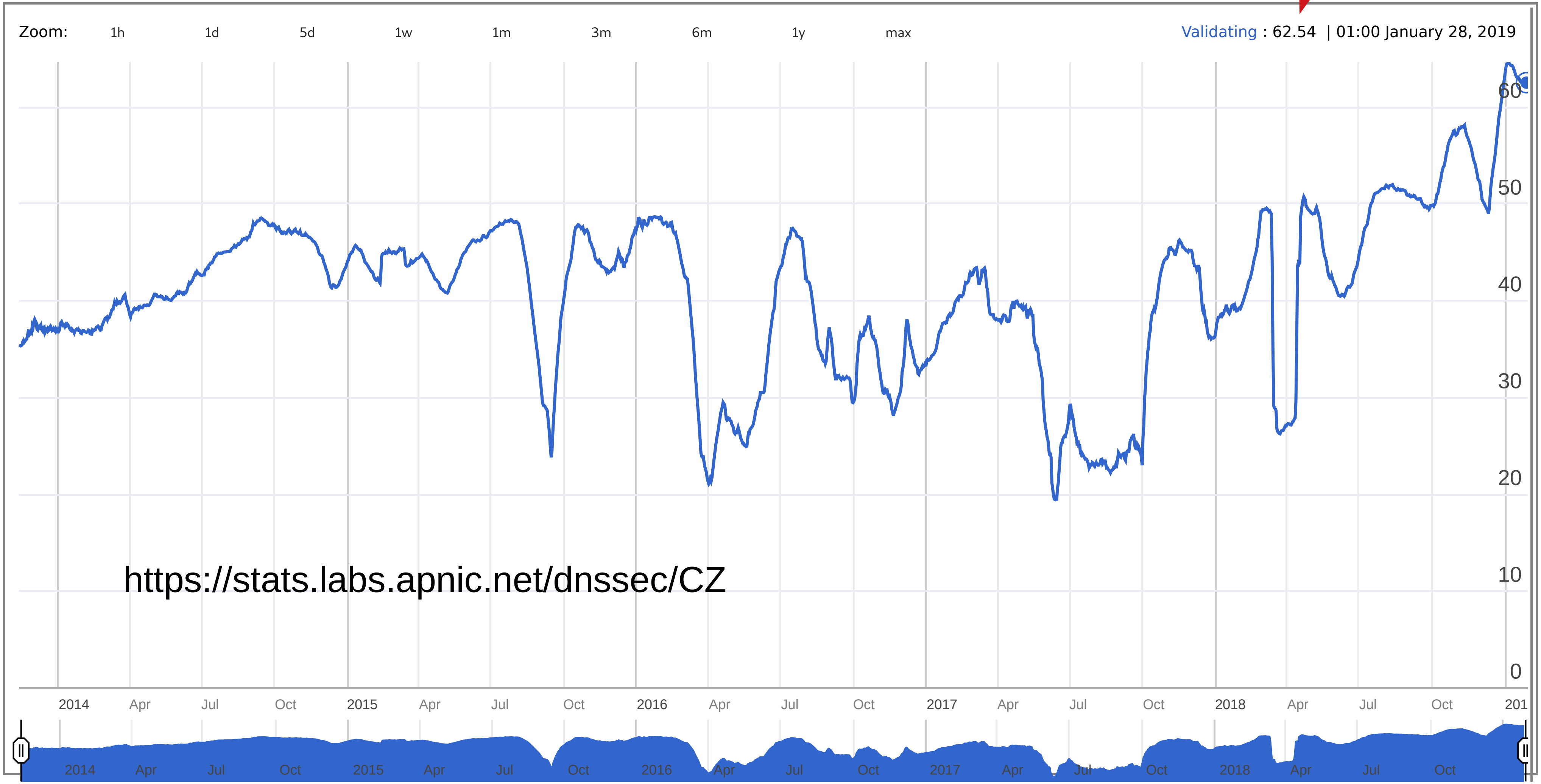
Validating : 23.99 | 01:00 January 26, 2019

https://stats.labs.apnic.net/dnssec/XE

DNSSEC? Who cares in CZ?

~ 63 %

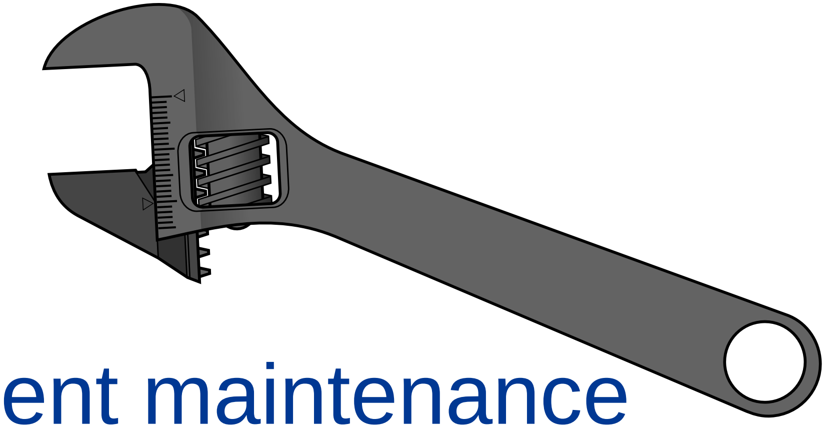
Use of DNSSEC Validation for Czech Republic (CZ)



Validating : 62.54 | 01:00 January 28, 2019

https://stats.labs.apnic.net/dnssec/CZ

Where is a problem?



- DNSSEC requires zone content maintenance
  - more work compared to insecure DNS

- Signatures with timestamps

```
.   RRSIG DNSKEY 8 0 172800
20190211000000 20190121000000 …
```

- Key propagation
  - `cz. DS 20237 13 2 CFF0F3ECDBC52…`

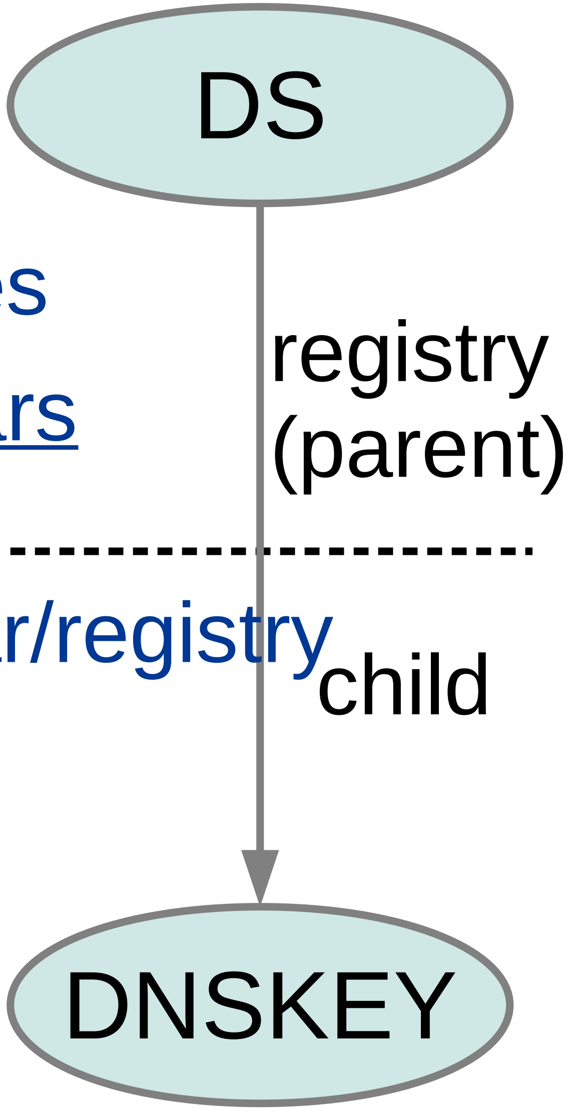
Maintenance?!

DNSSEC maintenance: signatures

- Refreshing signatures (timestamps)
  - **fully automated**
    Knot DNS, BIND, PowerDNS, OpenDNSSEC, ...

DNSSEC maintenance: keys

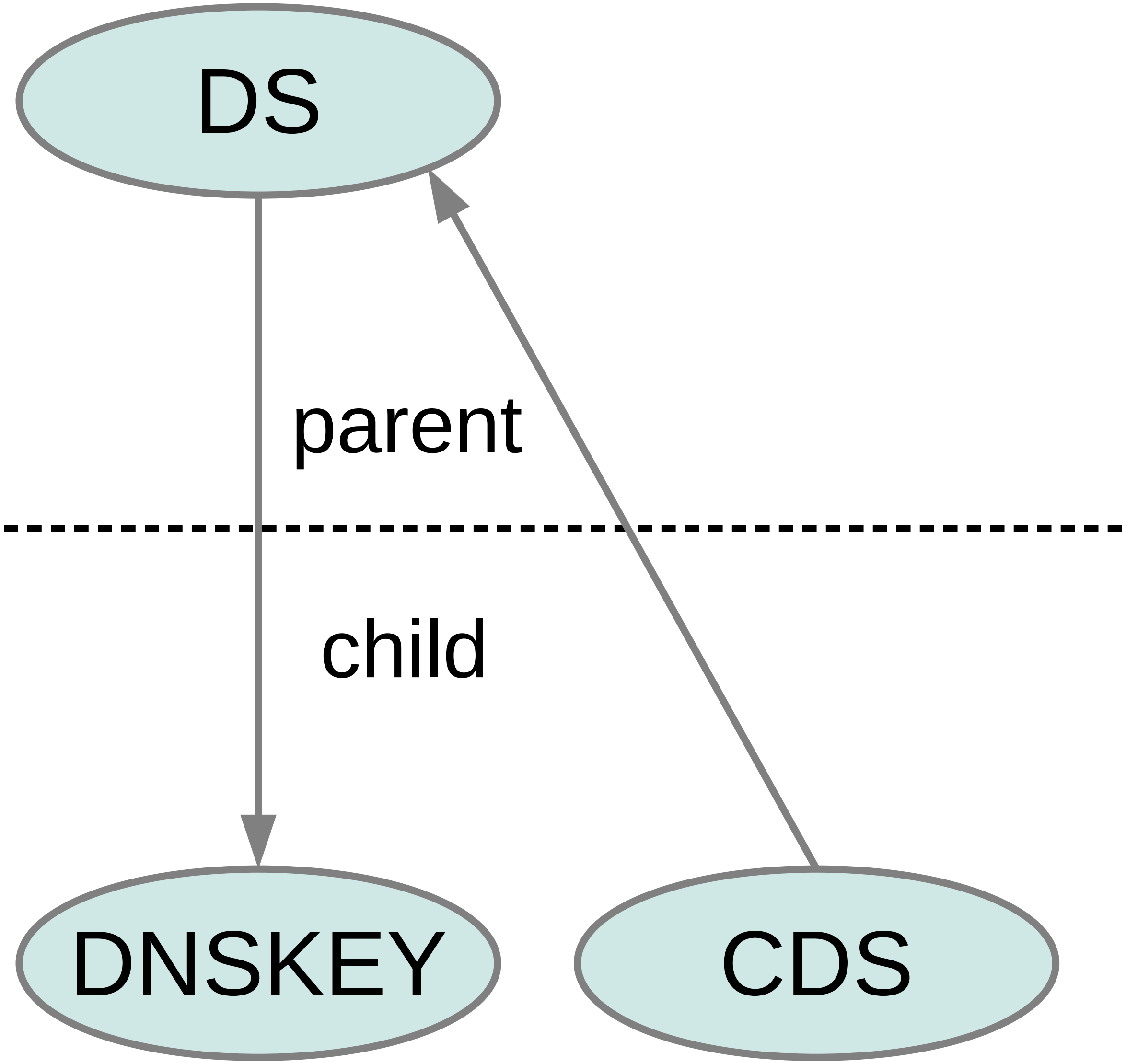
- Key propagation
  - **harder problem** – multiple parties
  - sub-optimal support from registrars
  - DNS providers
    have no relationship with registrar/registry
  - Domain holders do not care



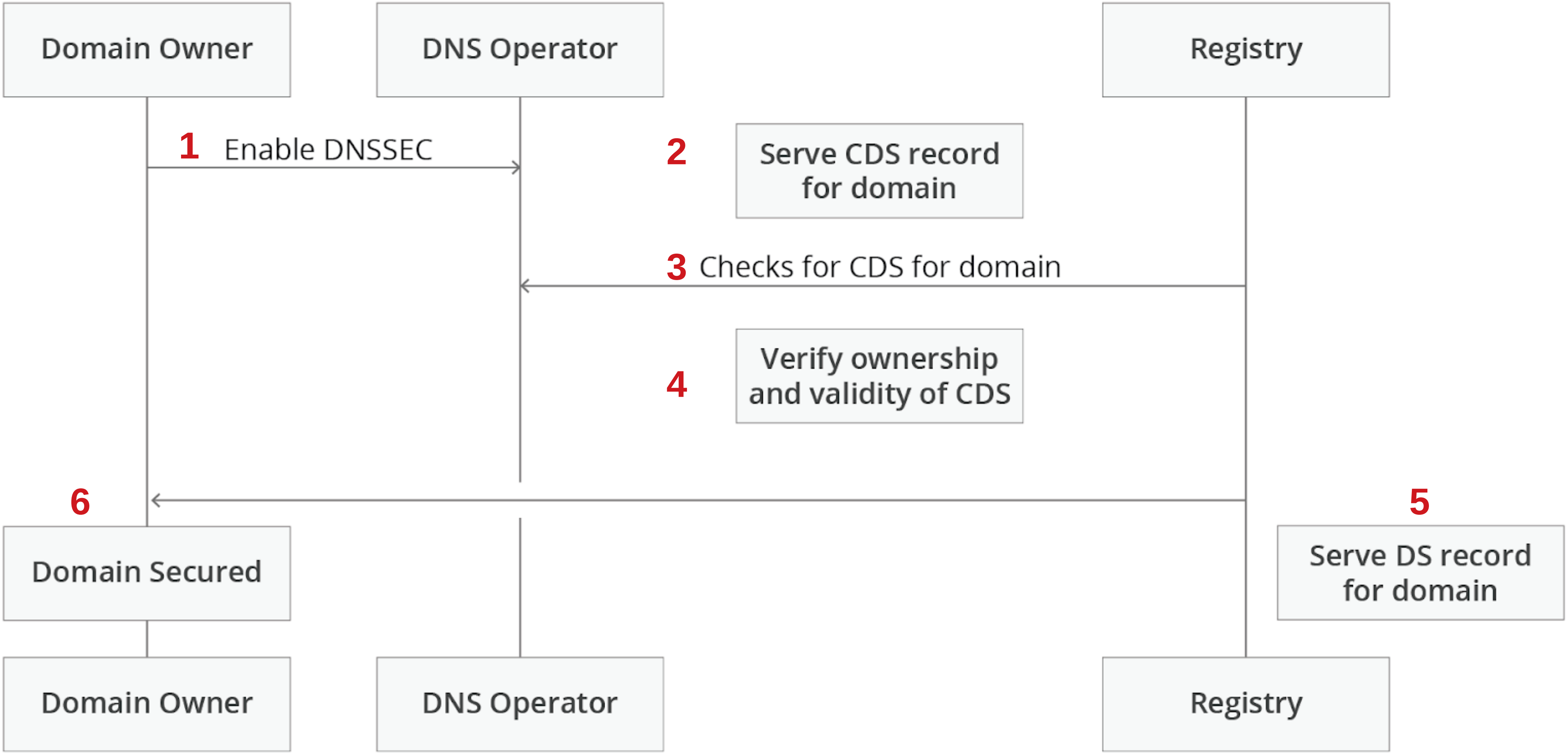
Standards to the rescue

- **RFC 7344** - Automating DNSSEC Delegation Trust Maintenance - September 2014
  - `cz. **CDS** 20237 13 2 CFF0F3ECDBC52…`
- **RFC 8078** - Managing DS Records from the Parent via CDS/CDNSKEY – March 2017
  - `cz. **CDS** 0 0 0 00`
- **draft-ietf-regext-dnsoperator-to-rrr-protocol** - Third Party DNS operator to Registrars/Registries Protocol

Standards to the rescue



DNSSEC Trust Maintenance: registry



Domain Owner
DNS Operator
Registry
1 Enable DNSSEC
2 Serve CDS record for domain
3 Checks for CDS for domain
4 Verify ownership and validity of CDS
6
5
Domain Secured
Serve DS record for domain
Domain Owner
DNS Operator
Registry

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Image attribution: Cloudflare

Implementation in registries

- Supported by
  - .ch
  - .cr
  - .cz
  - .li
- More coming
- Ask your registry!

Image attribution: Mozilla

Implementation in software

- OpenDNSSEC – planned
- PowerDNS – generates CDS RR, manual rollover using pdnsutil
- BIND 9.13 – generates CDS RR, manual rollover using dnssec-keymgr
  - BIND 9.15 – more automation planned
- **Knot DNS 2.6+ – generates CDS RR, rolls automatically (as configured)**

Key propagation in KNOT DNS

- KSK submission via CDS/CDNSKEY
- Periodic checks for DS existence via set of configured nameservers
  - Authoritative nameservers
  - And/or DNSSEC validating resolver
  - (all must see DS)
- Alternative: simple timeout

Configuration example

```
remote:
  - id: auth
    address: [ 198.51.100.5 ]
  # resolvers
  - id: local
    address: [ 192.0.2.1 ]
  - id: foreign
    address: [ 1.1.1.1 ]

submission:
  - id: upstream
    parent: [ auth, local, foreign ]
    check-interval: 600 s
```

```
policy:
  - id: ecdsa
    ksk-lifetime: 14d
    ksk-submission: upstream

template:
 - id: "default"
   dnssec-signing: on
   dnssec-policy: ecdsa

zones:
  - domain: dnssec.cz
```

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```

Key maintenance: logging

KNOT DNS

1)
```
2017-10-24T15:41:22 notice:
[dnssec.cz.] DNSSEC, KSK submission,
waiting for confirmation
```

2) Knot detects the updated parent’s DS record

- + waits for DS’s TTL before retiring the old key

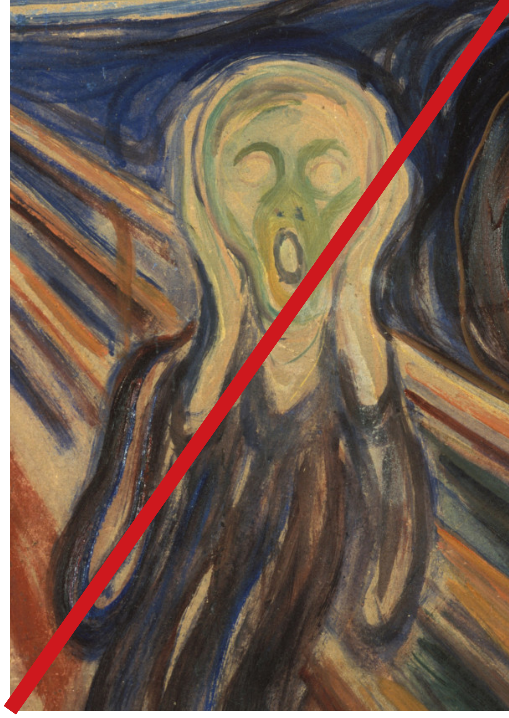
3)
```
2017-10-24T20:00:00 notice:
[dnssec.cz.] DNSSEC, KSK submission,
confirmed
```

Other relevant features

- DS deletion via `CDS 0 0 0 00`
- Structured logging for key events
  - custom hooks
- Automatic algorithm rollovers
- Push for DS RR (DNS Update) coming ...

Summary

- DNSSEC is becoming easy (finally!)
- Ask your registry or registrar for CDS/CDNSKEY support
- Update your software
- Sign your zones, please ;-)



KNOT DNS

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Backup slides

CDS/CDNSKEY implementation in CZ

CDNSKEY scanning

- Daily scanning all domains in zone for CDNSKEY records
  - Takes about 3 hours for .CZ
- Three categories of domains:
  - Without KeySet
  - With automatically generated KeySet
  - With legacy KeySet created by a registrar

Domains without KeySet

- Scanning all authoritative nameservers from registry database via TCP queries
- When CDNSKEY is found, technical contact is informed via e-mail
- Keep scanning for 7 more days
- If results are always the same (and it is not DS deletion), new KeySet is created and linked to a domain
    - Domain holder (via notify e-mail) and registrar (via EPP) are notified

Domains with automatic KeySet

- Scan for CDNSKEY via local resolver, DNSSEC is validated inside scanner
- If CDNSKEY is found, do as requested
  - Update KeySet with new DNSKEY or
  - Remove KeySet (notification of domain holder and registrar)
- Technical contact is informed via e-mail

Domains with legacy KeySet

- Scan for CDNSKEY via local resolver, DNSSEC is validated inside scanner
- If CDNSKEY is found, do as requested
  - Create new automatic KeySet and swap it in domain or
  - Remove KeySet
- Technical contact is informed via e-mail
- Domain holder (via notify e-mail) and registrar (via EPP) are notified