DANE: TLS Domain Name Authentication using the DNS Itself

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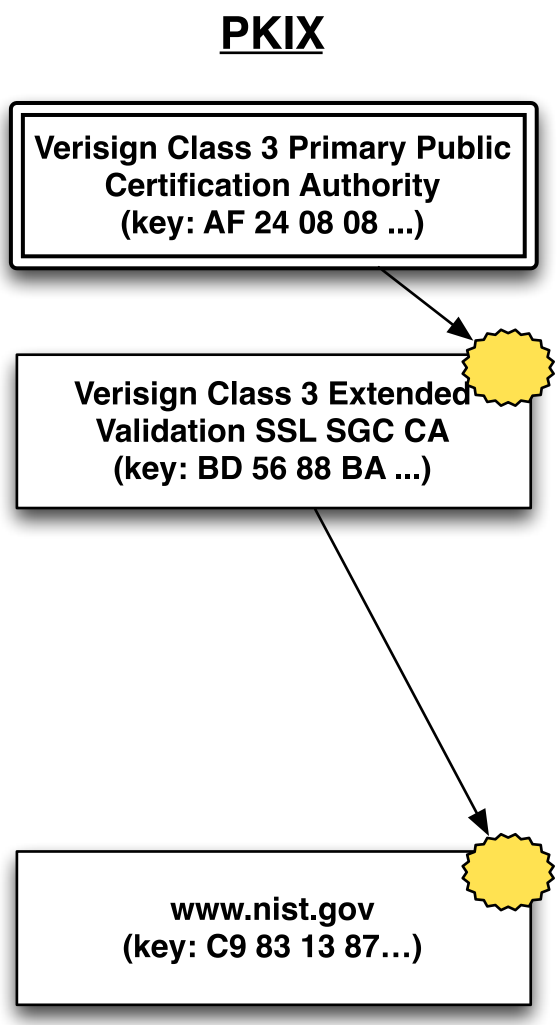
Security == Domain Names == PKI

- Basically all major security protocols rely on authenticating host names with certificates
  - TLS, IPsec
  - HTTPS, SIPS, SMTP/IMAPS, etc.
- EV certificates provide additional assurances, especially when user interaction is possible
- 95% of CA-issued certificates are DV
  - 35,661 EV vs. 603,481 DV [NetCraft, Jan 2011]

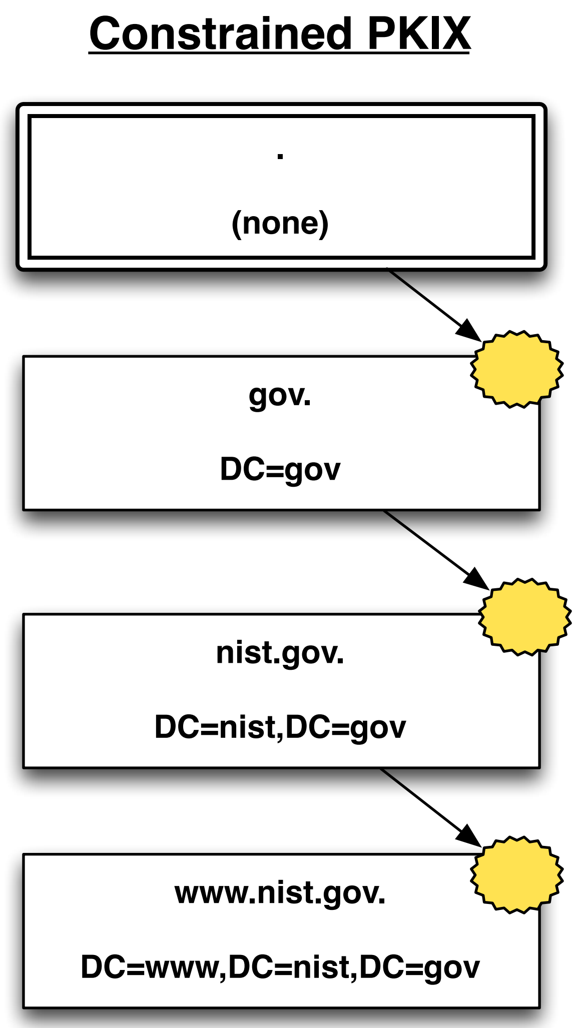
Scoping and Authority

- Current CA system is fundamentally unsuited for authenticating domain names
  - Anyone can vouch for anything
  - DigiNotar can vouch for Google
  - Nobody is authoritative for anything
- Patch on patch on patch
  - Pinning, CAA, Transparency, …



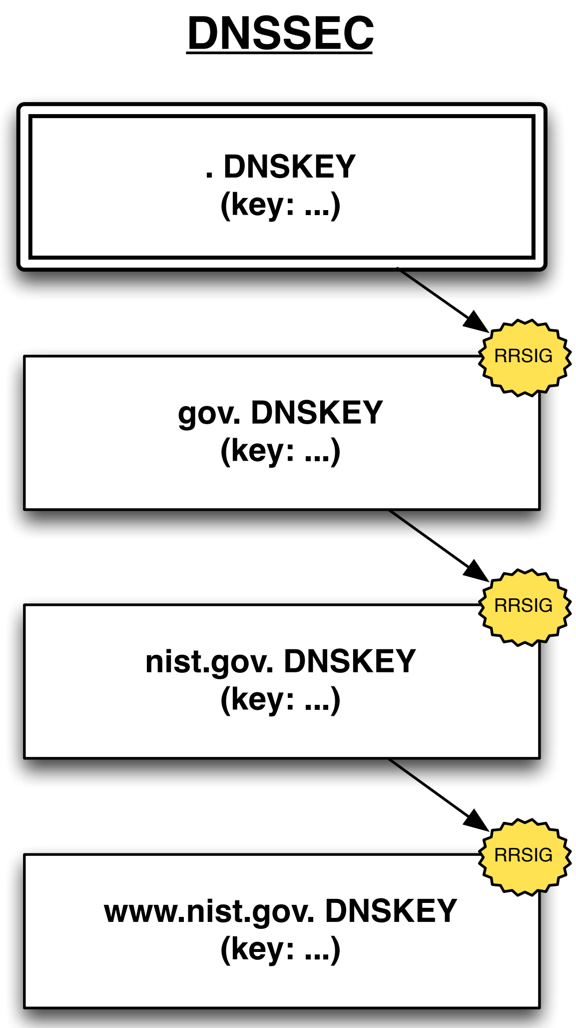
Constraining the PKI

- Hierarchy with name constraints
  - CA == domain holder
- Why hasn't this happened yet?
  - Support for name constraints
  - Economic reasons
  - Political reasons



The hierarchy you're looking for

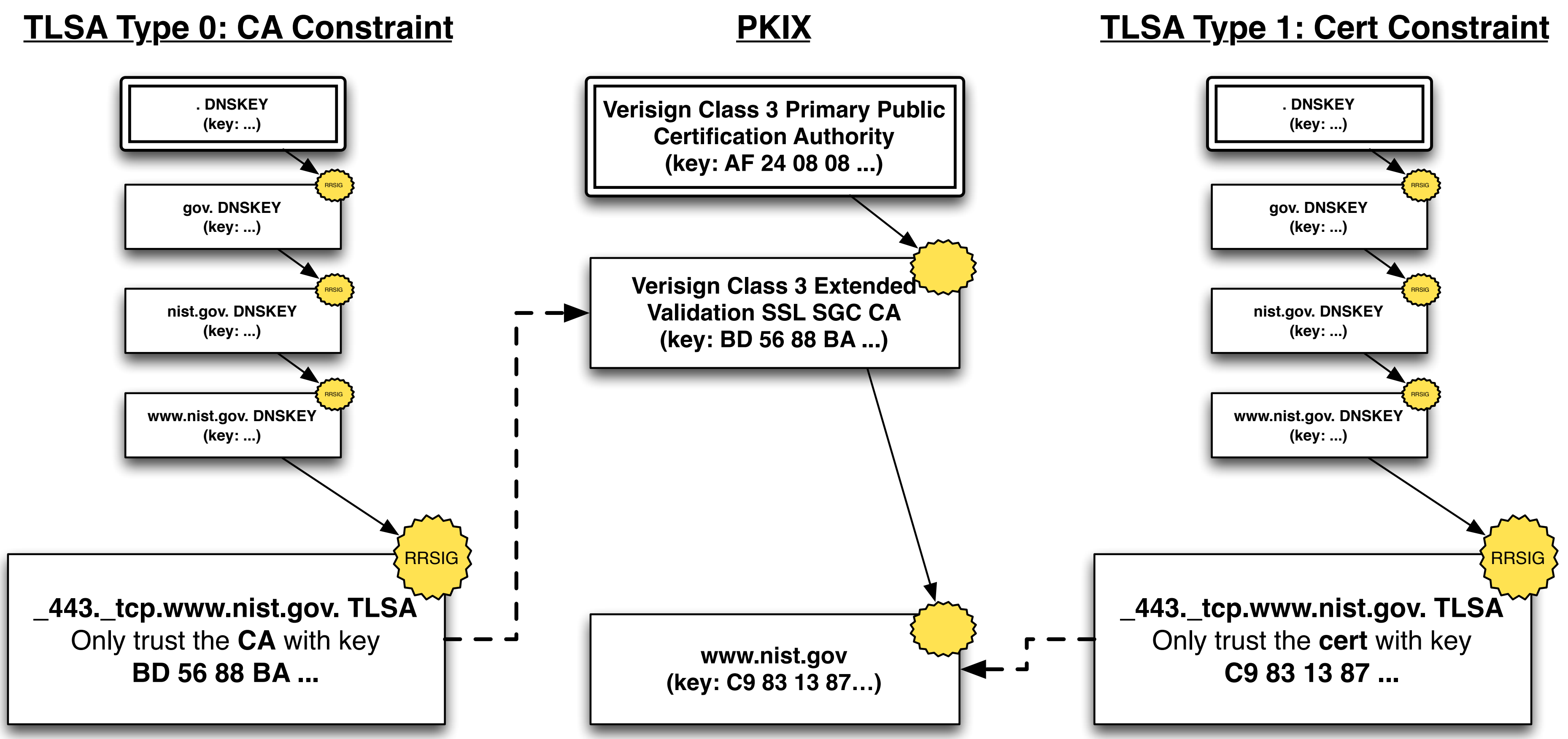
- Name constraints are central to DNSSEC
  - Keys are always scoped
- Econ/Politics might be easier
  - Root signed since 2010
  - Many TLD ops deploying
  - Some hosting providers
- What goes at the end of the chain?
- Interaction with PKI?



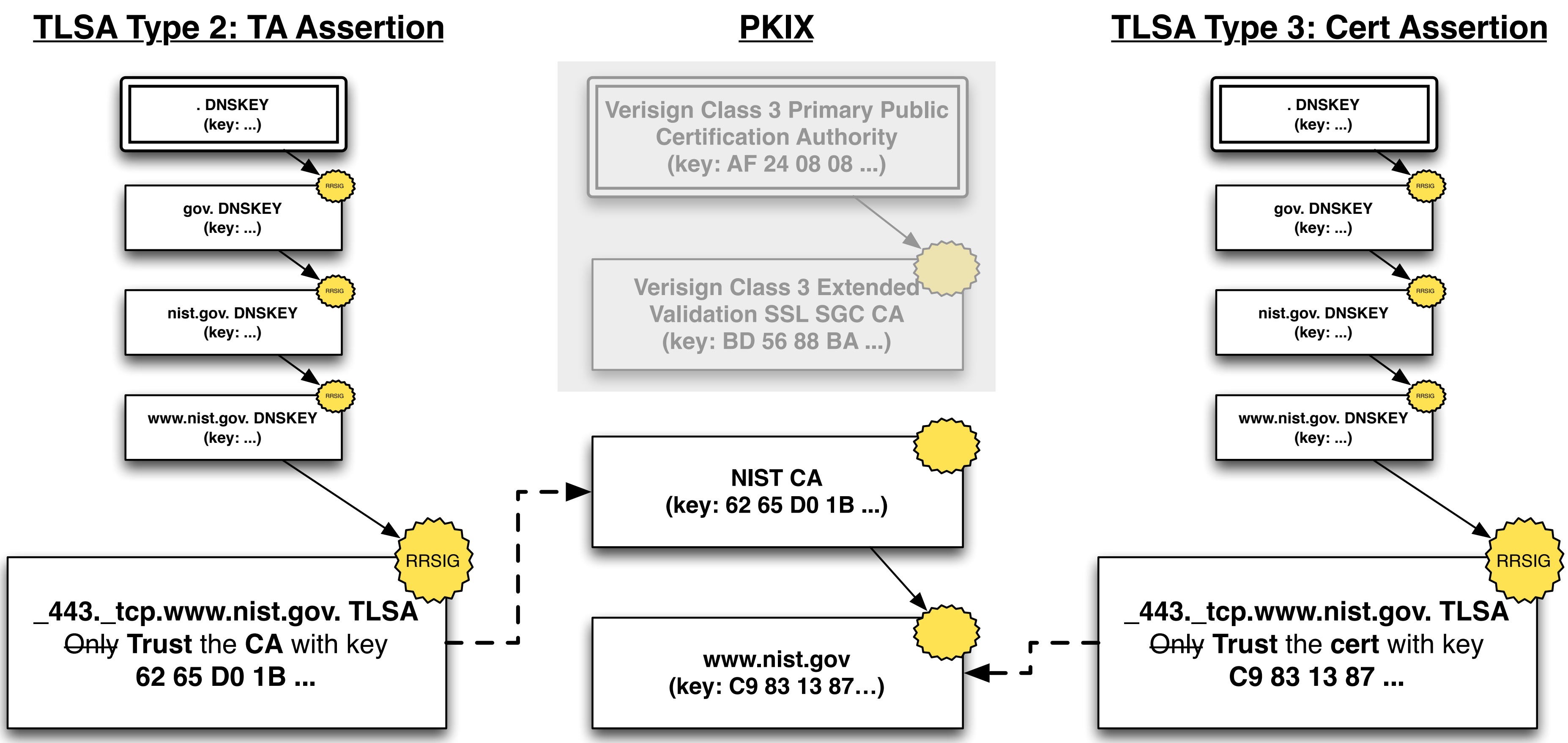
TLSA Records

- RFC 6698: TLS association records (TLSA)
  - TLS connects to a name
  - TLSA associates certificates to a name
- Types of association:
  - Type 0: CA constraint
  - Type 1: Certificate constraint
  - Type 2: TA assertion
  - Type 3: Certificate assertion

Type 0/1: Constraints



Type 2/3: Assertions



Truth in Advertising

DANE DOES

- Provide scoping of authority
- Make CAs untrusted for domain name validation
  - Secondary check, in addition to X.509 verification
  - Mitigates misissue

DANE DOES NOT

- Attest to other identity than domain name
- Remove authority risk completely
  - CAs → DNS operators

HOWEVER

- Type 0/1 with EV
- DNS operator could probably get a cert anyway

Deployment

- Before you get DANE, you need DNSSEC
  - Parent issues
  - Resolver issues
  - Client support issues
- Browser extensions with DNSSEC libraries
- DNSSEC “stapling”: Provide all necessary DNS records in TLS handshake

Future Work

- SRV / MX: How to deal with delegation
  - My mail domain is ipv.sx
  - `ipv.sx IN MX mail01.l.google.com`
  - Where do I look for TLSA records?
  - What if the delegation is not secure?
- S/MIME: How to find certs for email address
  - alice@example.com
  - alice._at.example.com IN TLSA?

Summary

- Authenticating domain names is important
- X.509 is not great for domain names
  - Especially as currently deployed
- DANE uses security in the DNS to secure domain names in applications
  - Constraints + assertions
- Deployment bound on DNSSEC, but starting…

Thanks!

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