ICANN proposal to sign the root

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DNSSEC…

- …protects the lookup like HTTPS/SSL protects the "conversation"
- …is about security – not control. Does not change control. Does not effect existing applications
- …is a PKI for DNS
- …if secured and trusted, is a global platform for innovation

Recent Events

- Calls from the community to sign the root: RIPE, SE, ORG, UK, APNIC + press
- **.se** signs their zone. Leads the way and is an example for others to do so. (2/2007)
- BR, BG, PR, CZ, MUSEUM sign their zones. Upcoming: ORG, GOV, UK, CA, …
- So…in close cooperation with DNSSEC deployment and security experts (.SE, .UK, IETF) developed signing system for .arpa and root. Signed root publicly available at ns.iana.org (and anycast pch-test.iana.org) for well over a year (6/2007)
- Presentations describing system and seeking feedback at various fora: IETF, RIPE, ICANN, OARC, etc..
- DNSSEC and root zone management are part of ICANN Strategic Plan – primary part of IANA function and ICANN business
- DNSSEC @ ICANN paper published (7/24/2008)
- Interim-TAR (almost there), Root Zone Management system (ongoing)
- Dan Kaminsky! (8/5/2008)
- US Government mandates DNSSEC for its own .gov use (8/22)
- ICANN submits proposal to sign the root (9/2)
- NTIA response (9/9) (http://www.icann.org/correspondence/)
- VeriSign submits proposal (9/22)
- Market crashes (10/1), Industry meeting on DNSSEC in DC
- NTIA announces 45-day NOI on signing the root (10/9) - end 11/24
- Early press http://blog.wired.com/27bstroke6/2008/10/who-should-sign.html

ICANN's root signing proposal

- No change in current control
- Accept no compromises in security
- Designed by Community for Community
- No one organization controls the key
- Regular auditing and reporting
- Timely deployment building on existing signed root and experience
- Maximum reliability through automation
- Flexible to support evolving landscape
- All Open Source

Elements of root signing

- Important elements of a root-signing solution are transparency, public consultation, broad stakeholder participation (e.g. key ceremony), flexibility, reliability, and trust;
- Solution has to balance various concerns, but must provide for a maximally secure technical solution and one that provides the trust promised by DNSSEC;
- An open, transparent and international participatory process will allow for root zone management to adapt to changing needs over time as DNSSEC is deployed throughout the Internet and as new lessons are learned.

Trust
preservation of trust from TLD operator to signed root

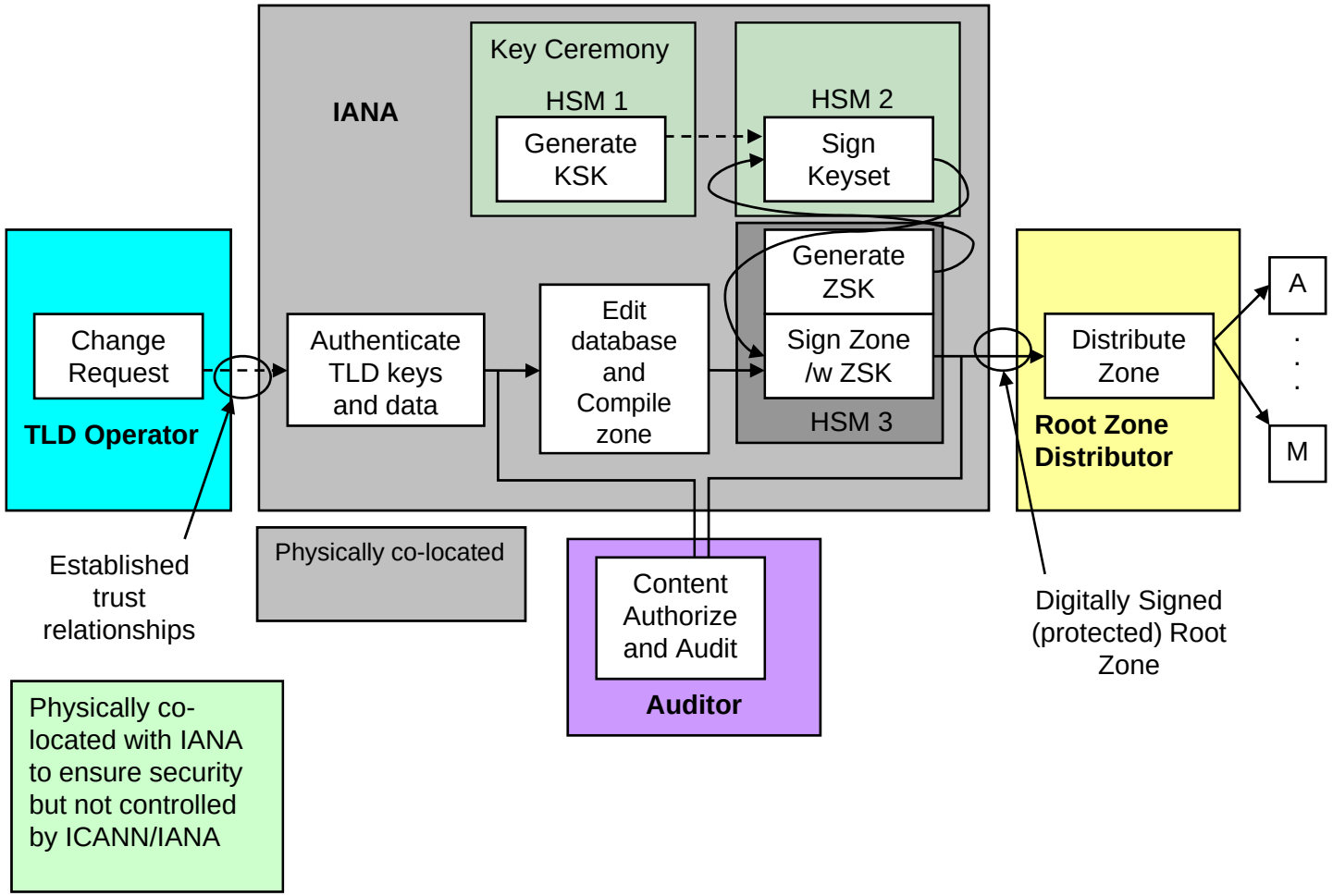
- PKI overlaid on DNS - treat it like one.
- A chain of trust
- Only as trustworthy as weakest link
- Intense pressure on root “link”
- A platform for innovation

…..if done right

Trust
the root key

- Anyone can generate keys and sign the root
- The resultant signed root has no value unless those it will serve agree to trust and use the key that signed it
- Publication of (the public half of) the key and attestation to the process, procedure, and equipment that generated it by the global Internet community gives it this value
- Classic cooperative definition for the Internet
- Broad stakeholder participation, e.g., Key Ceremony
- No one organization controls the key
- Balanced with stability and security

Overview


IANA
Key Ceremony
HSM 1
Generate KSK
HSM 2
Sign Keyset
Generate ZSK
Sign Zone /w ZSK
HSM 3
Edit database and Compile zone
Authenticate TLD keys and data
Change Request
TLD Operator
Established trust relationships
Physically co-located
Content Authorize and Audit
Auditor
Distribute Zone
Root Zone Distributor
A
M
Digitally Signed (protected) Root Zone
Physically co-located with IANA to ensure security but not controlled by ICANN/IANA

Capabilities

- Sophisticated L – root operations
- Comprehensive Registry Failover processes and procedures
- Root zone management is our business.
- DNSSEC is part of ICANN's Strategic Plan and budget
- Signed .arpa and root system developed closely with DNSSEC experts and publicly testing since June 2007
- Interim Trust Anchor Repository for TLDs
- Root zone management system
- Skilled staff

Preparedness

- IANA's signed root was developed closely with DNSSEC experts and based on Sweden's production .se deployment. Publicly available and testing for well over a year at ns.iana.org (and others)
- Collaboration and development with DNSSEC deployment and security experts has been a continual process as part of signing Internet infrastructure zone .arpa at the request of the IAB
- Original crypto interface (PKCS11) development to support flexible HSM usage shared with community. All DNSSEC work will be Open Source.
- IANA has deployed only the highest security (FIPS 140-2 Level 4) HSMs used by UN treaty organizations
- Developed sample Key Ceremony and other key management approaches with expert security engineering help to balance security, stability, and participation
- Operations in secure facilities (multiple biometrics, secure containers, etc..)
- …the list goes on but it is not our place to tell the community what to do. ICANN serves the community. So the community must tell us what to do. Public consultation and participation are key parts of the ICANN proposal.

Behind our testbed

System status at: https://ns.iana.org/dnssec/status.html
.arpa, in-addr.arpa, ip6.arpa, iris.arpa, urn.arpa, uri.arpa, .int, xn-"test" (DS: .se, .br, .bg, .pr, .cz, .museum.)

SIGNER, NS:
DELL 1950 /w
2xPS, 2XSAS,
2xCPU

HSM: AEP
KEYPER FIPS
140-2 Level 4
(Disposable)

HSM KSK

HSM ZSK

CLASS 5 GSA
NSA SAFE

10.0.2.X

SIGNER

SIGNER

10.0.1.X

NS

NS

199.7.81.10

199.7.81.15

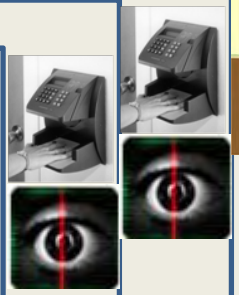
TSIG

ROOT DB

ADMIN

RZM

I-TAR



24 hr manned multiple biometric controlled facility, NSA NSTISSP #10, GSA Class 5 Container (approved for Top Secret)

ns.iana.org

208.77.188.32

F/W

2-factor auth for RZM

DUPLICATE TO 2-3 INSTANCES

pch-test.iana.org
Anycast

204.61.216.37

MONITORING SITES

MIA

BOS

AMS

LAX

TEST A

TEST M

TLD OPERATORS

149.20.64.22 public recursive resolver

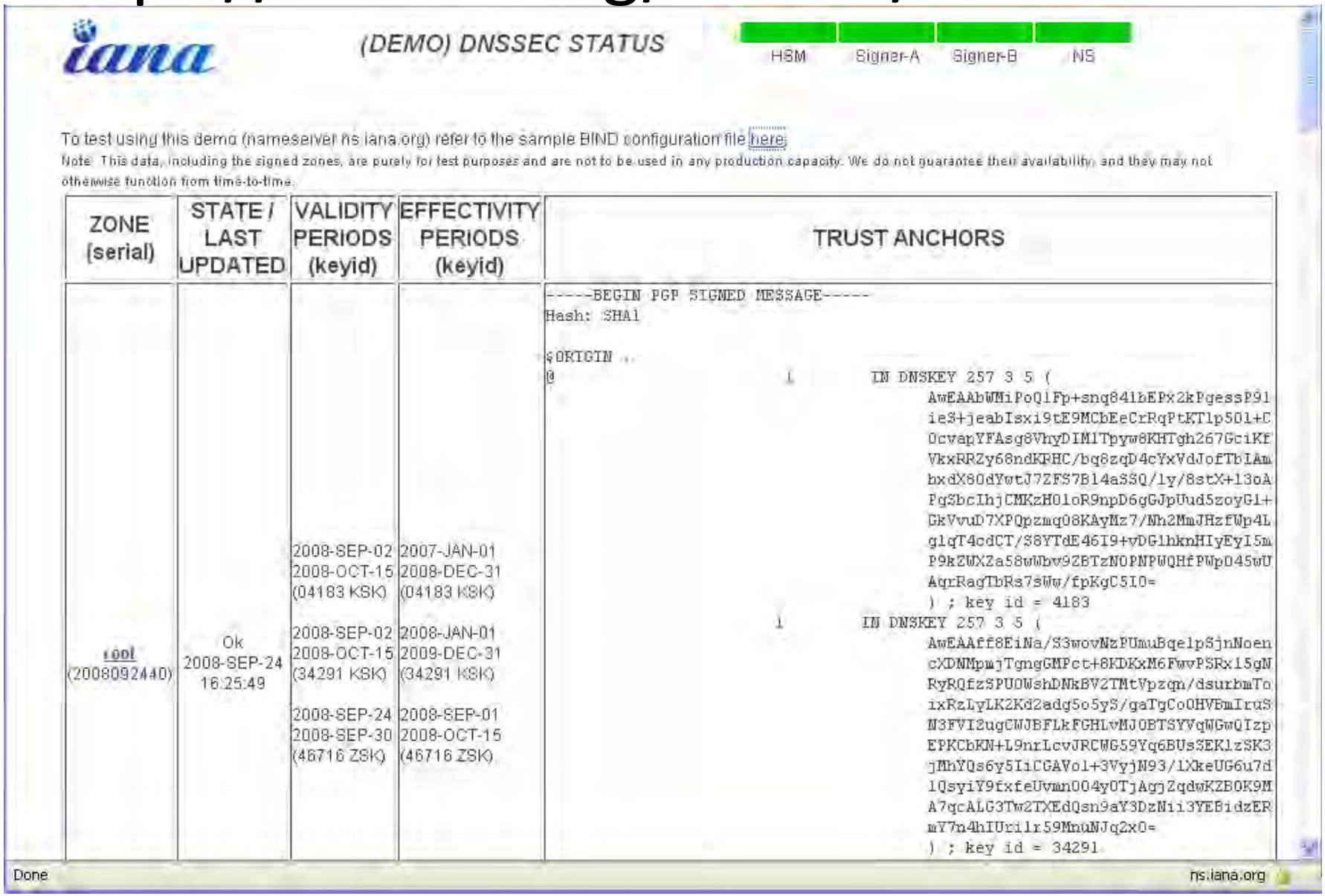
iana-testbed.odvr.dns-oarc.net

TLD DATA VETTING PROCESS

TLD OPERATORS AND/OR GOVERNMENTS

EXISTING TRUST RELATIONSHIPS

https://ns.iana.org/dnssec/status.html



iana

(DEMO) DNSSEC STATUS

HSM Signer-A Signer-B NS

To test using this demo (nameserver ns.iana.org) refer to the sample BIND configuration file here.

Note: This data, including the signed zones, are purely for test purposes and are not to be used in any production capacity. We do not guarantee their availability, and they may not otherwise function from time-to-time.

ZONE (serial)	STATE / LAST UPDATED	VALIDITY PERIODS (keyid)	EFFECTIVITY PERIODS (keyid)	TRUST ANCHORS
. (2008092440)	Ok 2008-SEP-24 16:25:49	2008-SEP-02 2008-OCT-15 (04183 KSK) 2008-SEP-02 2008-OCT-15 (34291 KSK) 2008-SEP-24 2008-SEP-30 (46716 ZSK)	2007-JAN-01 2008-DEC-31 (04183 KSK) 2008-JAN-01 2009-DEC-31 (34291 KSK) 2008-SEP-01 2008-OCT-15 (46716 ZSK)	-----BEGIN PGP SIGNED MESSAGE----- Hash: SHA1 $ORIGIN . @ 1 IN DNSKEY 257 3 5 (AwEAAbWMiPoQ1Fp+snq84lbEPx2kPgessP91 ieS+jeabIsxi9tE9MCbEeCrRqPtKTlp5O1+C OcvapYFAsg8VhyDIM1Tpyw8KHTgh267GciKf VkxRRZy68ndKRHC/bq8zqD4cYxVdJofTbIAm bxdX80dYwtJ7ZFS7B14aSSQ/1y/8stX+l3oA PgSbcIhjCMKzH01oR9npD6gGJpUud5zoyG1+ GkVvuD7XPQpzmq08KAyMz7/Nh2MmJHzfWp4L glqT4cdCT/S8YTdE46I9+vDG1hknHIyEyI5m P9kZWXZa58wWbv9ZBTzNOPNPWQHfPWp045wU AqrRagTbRs7sWw/fpKgC5IO=) ; key id = 4183 1 IN DNSKEY 257 3 5 (AwEAAff8EiNa/S3wovNzPUmuBqelpSjnNoen cXDNMpmjTgngGMPct+8KDKxM6FwvPSRx15gN RyRQfzSPUOWshDNkBV2TMtVpzqm/dsurbmTo ixRzLyLK2Kd2adg5o5yS/gaTgCo0HVBmIruS N3FVI2ugCWJBFLkFGHLvMJ0BTSYVqWGwQIzp EPKCbKN+L9nrLcvJRCWG59Yq6BUsSEKlzSK3 jMhYQs6y5IiCGAVol+3VyjN93/lXkeUG6u7d lQsyiY9fxfeUvmn004yOTjAgjZqdwKZB0K9M A7qcALG3Tw2TXEdQsn9aY3DzNii3YEBidzER mY7n4hIUrilr59MnuNJq2xO=) ; key id = 34291

Done ns.iana.org

Go ahead – test it

- Recursive public DNSSEC resolver at 149.20.64.22 (iana-testbed.odvr.dns-oarc.net). Thank you OARC!

- Masters: 208.77.188.32 (ns.iana.org) and anycast 204.61.216.37 (pch-test.iana.org). Thank you PCH!

US Department of Commerce/NTIA Notice of Inquiry

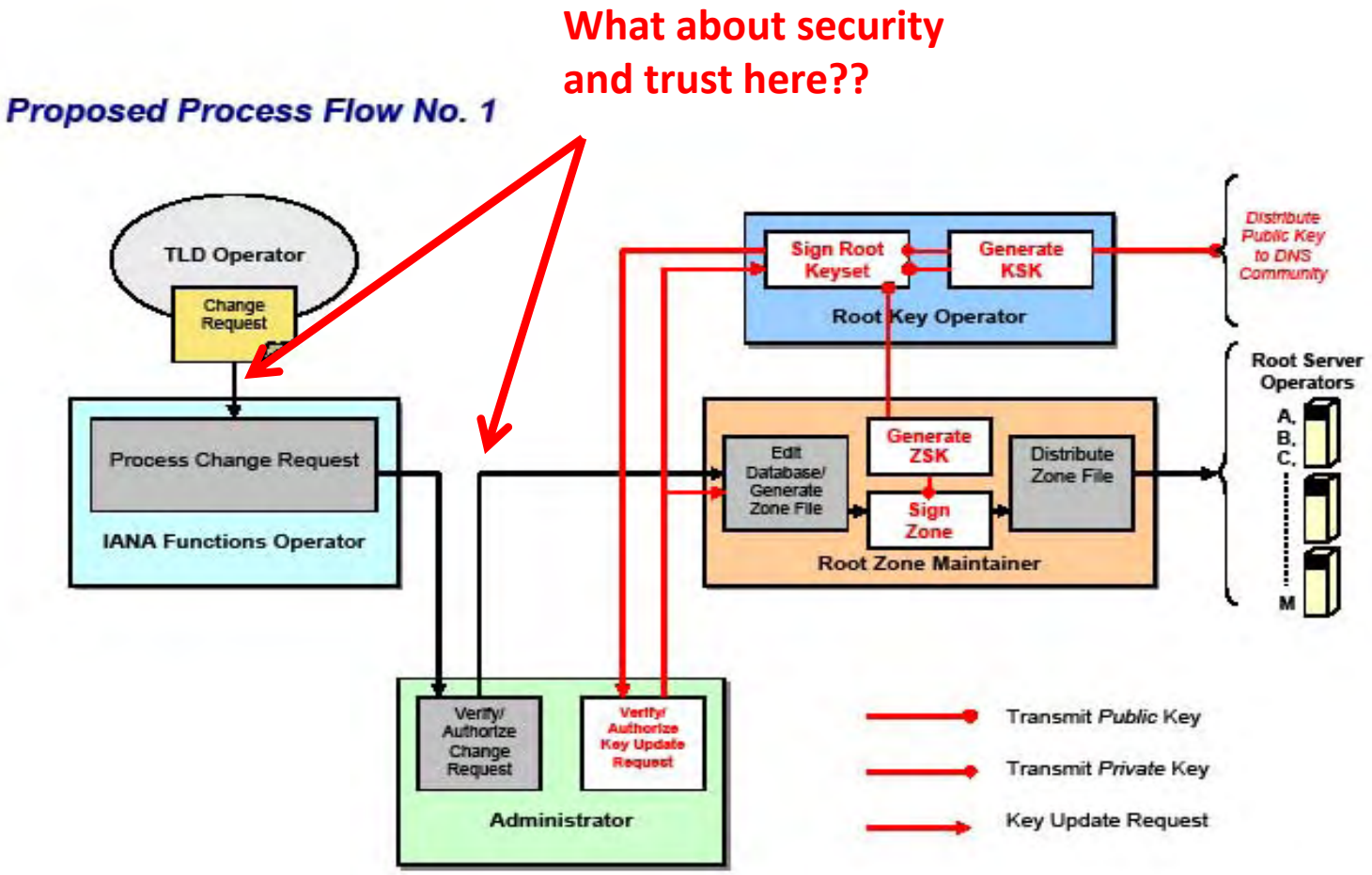
www.ntia.doc.gov/DNS/DNSSEC.html

- Congratulations. A good read! Overall a pretty fair and accurate treatment of the issue.
- However absent throughout the text and flow diagrams is the representation of the trust from TLD operator to signed root. (e.g. the multiple levels of TLD key vetting and validation and the incorporation of those keys into the signed root).
- VeriSign and ICANN proposals published in their entirety
- Comments from all stakeholders in the global Internet community will make a difference!

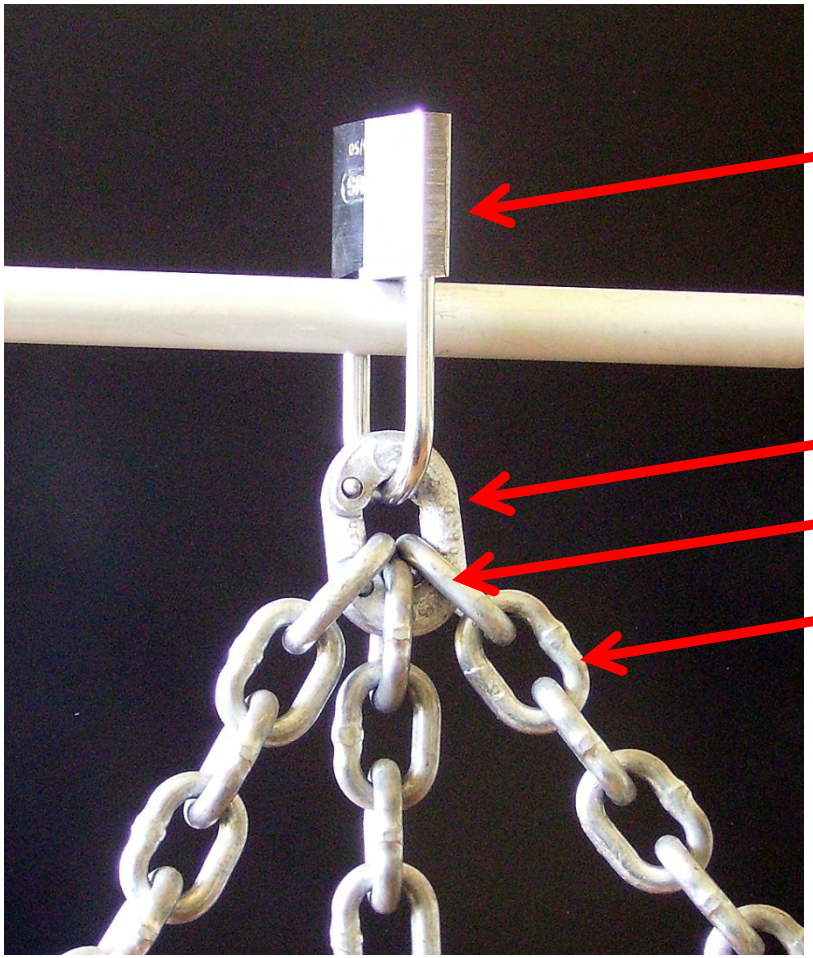
Comparison of proposals

- ICANN
  - No restrictions on design
  - IANA vets TLD keys and immediately signs zone file
  - DNSSEC experts from community design final system, including KSK handling, for ICANN to implement
  - Community determines “who, how, where”. Design by the community for the community.
- VeriSign
  - IANA vets TLD keys and transmits keys to VeriSign who signs zone file
  - M of N KSK handling by 12 root server operators
  - Assumes IANA cannot create zone file

What's Missing in the NOI



A chain of trust (ICANN proposal)



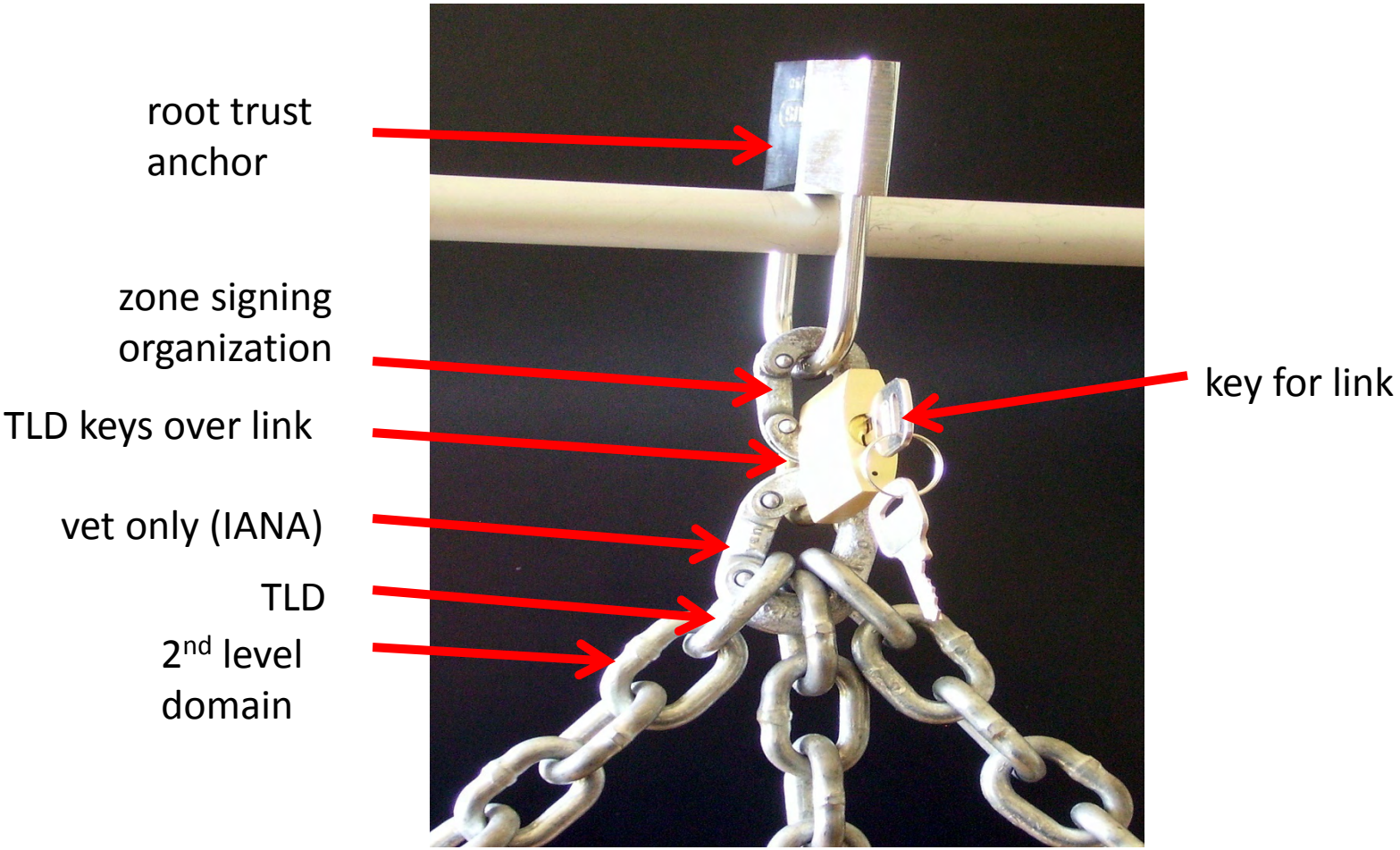
root trust anchor

vet+sign (IANA)

TLD

2nd level domain

…an extra link in the chain



- Why add another link?
- An avenue for key corruption.
- Who has key to this link?
- How is that key managed?
- Would you trust your savings to this?
- Keep it simple

Summary of ICANN's root signing proposal

- No change in current control
- Accept no compromises in security
- Designed by Community for Community
- Timely deployment building on existing signed root and DNSSEC expert experience
- Flexible and open as DNSSEC evolves – in technology and policy

Its your root

- Help design it
- Help test it
- Help run it
- Make it a trusted platform for innovation
- Your feedback counts! Comment to the NOI!

Interim Trust Anchor Repository

- What is an ITAR?
- Interim Trust Anchor Repository
- A mechanism to publish keys of top-level domains that currently implement DNSSEC
- When the root zone is DNSSEC signed, such a repository is unnecessary
- Therefore this is a stopgap measure
- Should be decommissioned when the root is signed

Publishing formats

- Publication formats
  - List on website
  - XML structured format
  - Master file format
- Should work with major software implementations
- Formats are plain text and readable so implementers can modify to suit
- Implementers should not be putting special ITAR provisions in code — this is meant to go away when the root is signed!

Availability

- Open to top-level domain operators in a week or two
- Asked to play with it for a week or so, try revoking etc.
- System will then be reset to contain only valid records
- Open to general public once TLD operators who sign have opportunity to list keys
- Expected in a few weeks

Thank you

and

This was not done alone! Thanks to the many experts from the Internet community!!

Questions?