DNSSEC for the Root Zone

IEPG @ IETF'76
8 November 2009

Richard Lamb, ICANN

Joe Abley, ICANN

Matt Larson, VeriSign

This design is the result of a cooperation between ICANN & VeriSign with support from the U.S. DoC NTIA

Design Requirements
Keywords

Transparency

Processes and procedures should be as open as possible for the Internet community to trust the signed root

Audited

Processes and procedures should be audited against industry standards, e.g. ISO/IEC 27002:2005

High Security

Root system should meet all NIST SP 800-53 technical security controls required by a HIGH IMPACT system

Roles and Responsibilities

ICANN

IANA Functions Operator

- Manages the Key Signing Key (KSK)
- Accepts DS records from TLD operators
- Verifies and processes request
- Sends update requests to DoC for authorization and to VeriSign for implementation

DoC NTIA

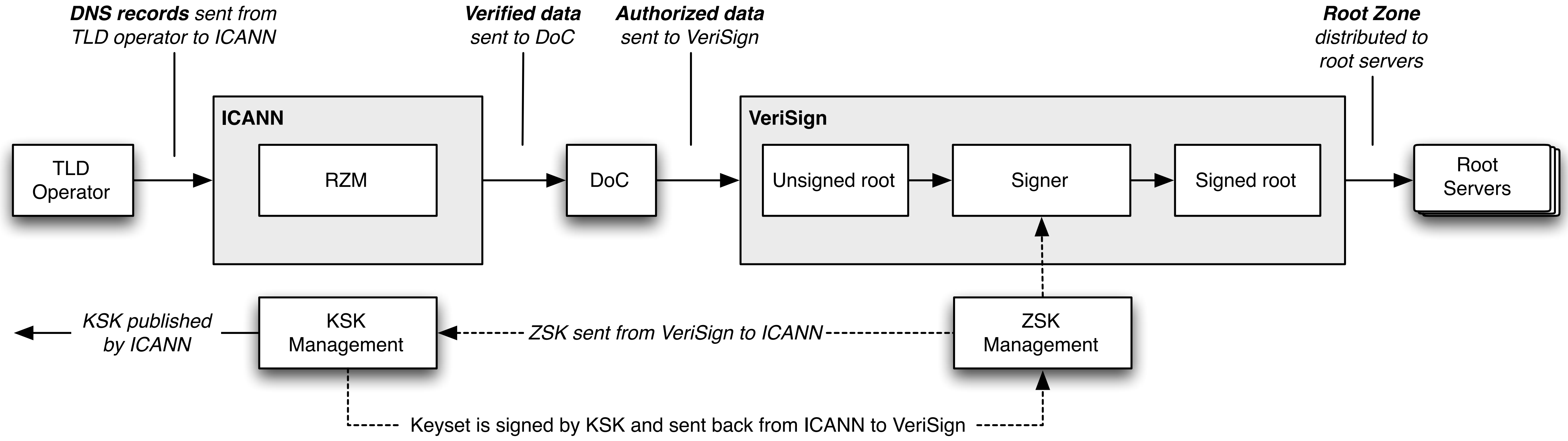
U.S. Department of Commerce
National Telecommunications and Information Administration

- Authorizes changes to the root zone
  - DS records
  - Key Signing Keys
  - DNSSEC update requests follow the same process as other changes
- Checks that ICANN has followed their agreed upon verification/processing policies and procedures

VeriSign

Root Zone Maintainer

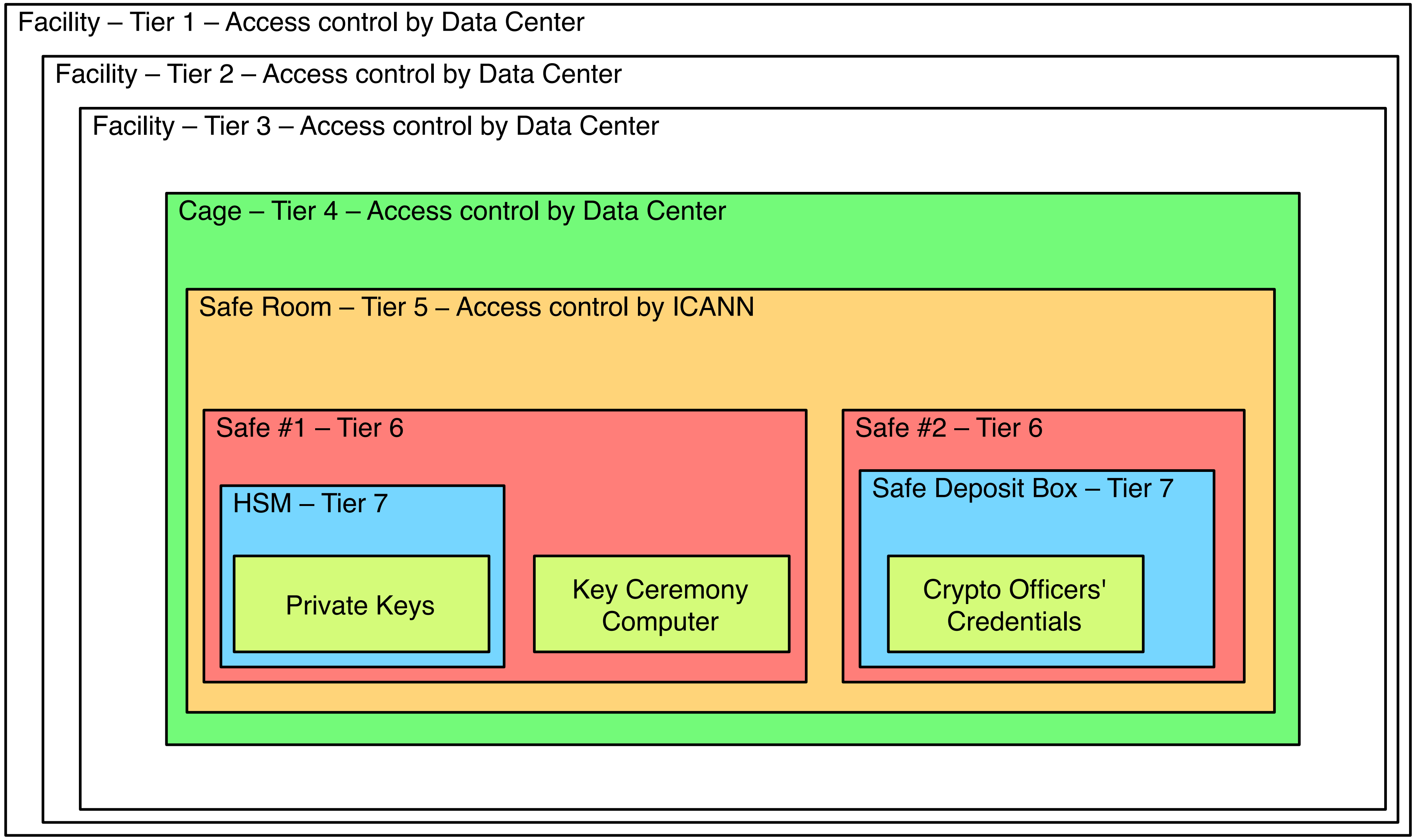
- Manages the Zone Signing Key (ZSK)
- Incorporates NTIA-authorized changes
- Signs the root zone with the ZSK
- Distributes the signed zone to the root server operators



DNS records sent from
TLD operator to ICANN
Verified data
sent to DoC
Authorized data
sent to VeriSign
Root Zone
distributed to
root servers
TLD
Operator
ICANN
RZM
DoC
VeriSign
Unsigned root
Signer
Signed root
Root
Servers
KSK published
by ICANN
KSK
Management
ZSK sent from VeriSign to ICANN
ZSK
Management
Keyset is signed by KSK and sent back from ICANN to VeriSign

Proposed Approach to Protecting the KSK

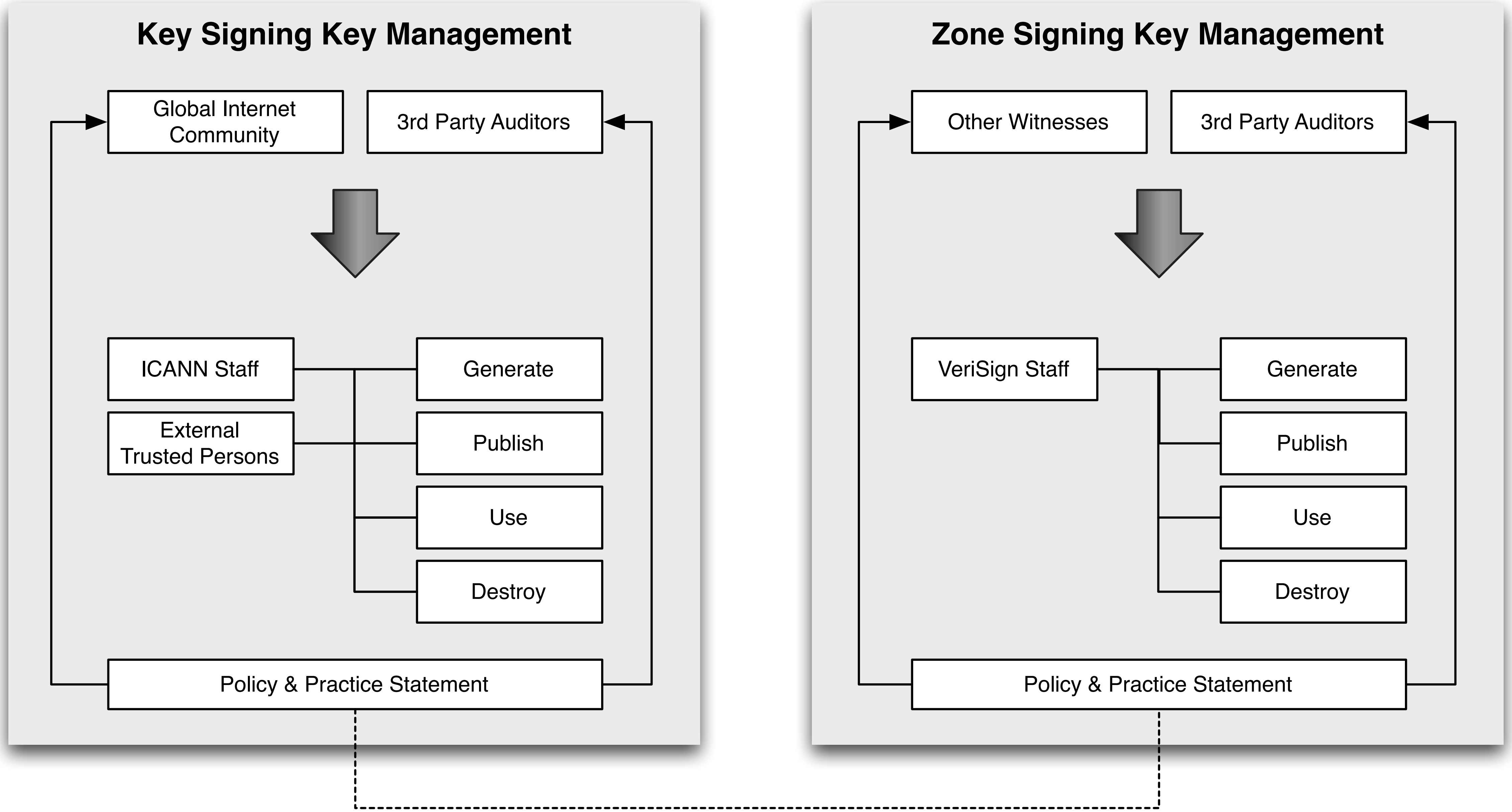
Physical Security


Facility – Tier 1 – Access control by Data Center
Facility – Tier 2 – Access control by Data Center
Facility – Tier 3 – Access control by Data Center
Cage – Tier 4 – Access control by Data Center
Safe Room – Tier 5 – Access control by ICANN
Safe #1 – Tier 6
HSM – Tier 7
Private Keys
Key Ceremony Computer
Safe #2 – Tier 6
Safe Deposit Box – Tier 7
Crypto Officers' Credentials

DPS

DNSSEC Policy & Practice Statement

- States the practices and provisions that are employed in root zone signing and zone distribution services
  - Issuing, managing, changing and distributing DNS keys in accordance with the specific requirements of the U.S. DoC NTIA
- Comparable to a certification practice statement (CPS) from an X.509 certificate authority (CA)


Key Signing Key Management
Global Internet Community
3rd Party Auditors
ICANN Staff
External Trusted Persons
Generate
Publish
Use
Destroy
Policy & Practice Statement
Zone Signing Key Management
Other Witnesses
3rd Party Auditors
VeriSign Staff
Generate
Publish
Use
Destroy
Policy & Practice Statement

Community Trust

- Proposal that community representatives* have an active roll in management of the KSK
    - as Crypto Officers needed to activate the KSK
    - as Backup Key Share Holders protecting shares of the symmetric key that encrypts the backup copy of the KSK

*) drawn from members of entities such as ccNSO, GNSO, IAB, RIRs, ISOC

Auditing & Transparency

- Third-party auditors check that ICANN operates as described in the DPS
- Other external witness may also attend the key ceremonies

Proposed DNSSEC Protocol Parameters

Key Signing Key

- KSK is 2048-bit RSA
    - Rolled every 2-5 years
    - RFC 5011 for automatic key rollovers

- Propose using signatures based on SHA-256

Zone Signing Key

- ZSK is 1024-bit RSA
  - Rolled once a quarter (four times per year)
- Zone signed with NSEC
- Propose using signatures based on SHA-256

Signature Validity

- DNSKEY-covering RRSIG validity 15 days
  - re-sign every 10 days
- Other RRSIG validity 7 days
  - re-sign twice per day (with zone generation)

Key Ceremonies

- Key Generation
  - Generation of new KSK
  - Every 2-5 years
- Processing of ZSK Signing Request (KSR)
  - Signing ZSK for the next upcoming quarter
  - Every quarter

Root Trust Anchor

- Published on a web site by ICANN as
  - XML-wrapped and plain DS record
    - to facilitate automatic processing
  - PKCS #10 certificate signing request (CSR)
    - as self-signed public key
    - Allows third-party CAs to sign the KSK

Proposed Deployment

Roll Out

- Incremental roll out of the signed root
  - Groups of root server “letters” at a time
- Watch the query profile to all root servers as roll out progresses
- Listen to community feedback for any problems

No validation

- Real keys will be replaced by dummy keys while rolling out the signed root
  - Signatures will not validate during roll out
  - Actual keys will be published at end of roll out

Draft Timeline

- December 1, 2009
    - **Root zone signed**
        - Initially signed zone stays internal to ICANN and VeriSign
    - ICANN and VeriSign begin KSR processing
        - ZSK and KSK rolls
- January - July 2010
    - Incremental roll out of signed root
- July 1, 2010
    - KSK rolled and trust anchor published
    - **Signed root fully deployed**

Documentation

- NTIA Requirements and High Level Technical Architecture posted:
    - http://www.ntia.doc.gov/dns/dnssec.html

- Draft DPS for ICANN and VeriSign will be posted in very near future.

Thoughts?

- Feedback on this proposal would be extremely welcome
    - Queue at the mic
    - Email to root-dnssec-feedback@verisignlabs.com

Root DNSSEC Design Team

Joe Abley
David Blacka
David Conrad
Richard Lamb
Matt Larson
Fredrik Ljunggren
David Knight
Tomofumi Okubo
Jakob Schlyter