DNSSEC Exposed

Deploying DNSSEC in Real Life

Internet Systems Consortium

Version 12

About the Presenter

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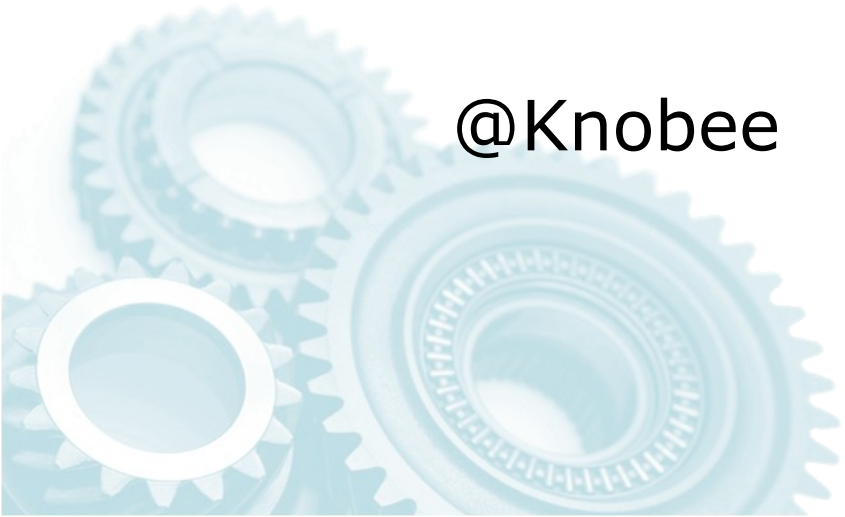

About ISC

- Internet Systems Consortium, Inc.
  - Headquartered in Redwood City, CA
  - 501(c)(3) Nonprofit Corporation

- ISC is a public benefit corporation dedicated to supporting the infrastructure of the universal connected self-organizing Internet — and the autonomy of its participants — by developing and maintaining core production quality software, protocols, and operations.

is the New "COBOL"

Deploy DNSSEC
NOW .... or something
bad might happen...

based Company looking for
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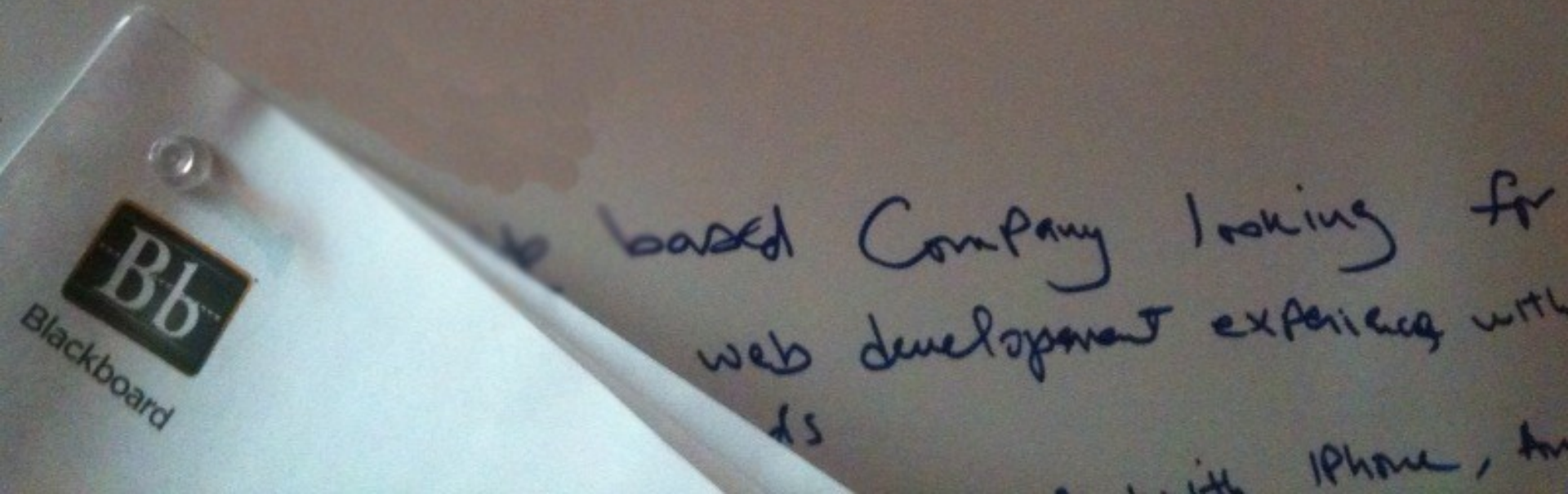
ds
iPhone, and

is the New "COBOL"

Define a security standard for DNS that CAN be deployed, and operators will. ⟹ Deploy DNSSEC NOW .... or something bad might happen...



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Understanding DNSSEC

Introduction

- Contemplate for a moment the amount of trust that we put into the DNS infrastructure

- If DNS were to suddenly become unreliable or untrustworthy, what would the result be?

Introduction

- With millions of recursive, caching servers on the Internet…
  - Each one needs to be able to be able to look up data from millions of zones
  - There is no way to distribute secret keys
    - Existing technology (TSIG) did not scale well

Introduction

- Central concept:

DNS data is augmented by a signature

- Validating resolvers can use the signature to verify that the data is authentic

Introduction

- DNSSEC is based on public key (asymmetrical) cryptography
  - Private key is used to sign DNS data
  - Public key is published via DNS so that validators can retrieve it
  - The public key is then used to validate the signatures, and there-by, the DNS data

Introduction

- DNSSEC provides cryptographic proof that the data received in response to a query is un-modified

- It does not deal with validating dynamic updates, nor with master to slave data transfers

Introduction

- DNSSEC enabled authoritative servers provide digital signatures across RRsets in addition to "standard" DNS responses

- DNSSEC validating resolvers provide authenticated responses with proven integrity

Introduction

- Clients using validating resolvers get "guaranteed good" results

- Data that does not validate provides a "**`SERVFAIL`**" response from the upstream resolver

Trust Validation

- With this knowledge, we are able to prove that data hasn't changed between the authoritative server and the validator, but how do we know we can trust it?

- Now that the root (".") is signed, that's easy, right?

Trust Validation

- DNSSEC is based on chains of trust
- At the top of chains are "trust-anchors"
  - One (signed) root, one trust-anchor
  - Until all TLDs are signed, it's not so easy
  - Trust anchors must be gathered and added to DNS configuration through leaps of faith

Trust Validation

- In BIND, trust anchors are added in "trusted-keys" statements

```
trusted-keys {
   . 257 3 8 "AwEAA[..]ihz0=";
};
```

- This creates an anchor based at the DNS root from which a chain is created

Chain of Trust

- Once a "trust anchor" is inserted, how does it actually create trust that leads down the DNS tree?

- Trust anchors consist of bits capable of validating the key used to sign the key that signs data in a given zone

Chain of Trust

- First, we must realize that there are TWO keys inserted into each zone
  - Zone Signing Key (ZSK)
    - Used to sign the resource records in the zone being secured
  - Key Signing Key (KSK)
    - Used to sign the Zone Signing Key

Chain of Trust

- Delegation of signed zones include a new Resource Record type
  - Delegation Signer – `DS`
  - Hash of the public portion of the child's Key Signing Key

Chain of Trust

- If the `DS` record in the parent is signed using the parent's zone signing key, we know that the `DS` record is valid.

- If the hash of the child's Key Signing Key record matches the `DS` record then we know that the Key Signing Key is valid.

Chain of Trust

- If the Key Signing Key is known to be valid, its signature of the Zone Signing Key proves that the Zone Signing Key is valid.

- If the Zone Signing Key is known to be valid, it can be used to validate other RRs in the zone.

Chain of Trust

- A living example:

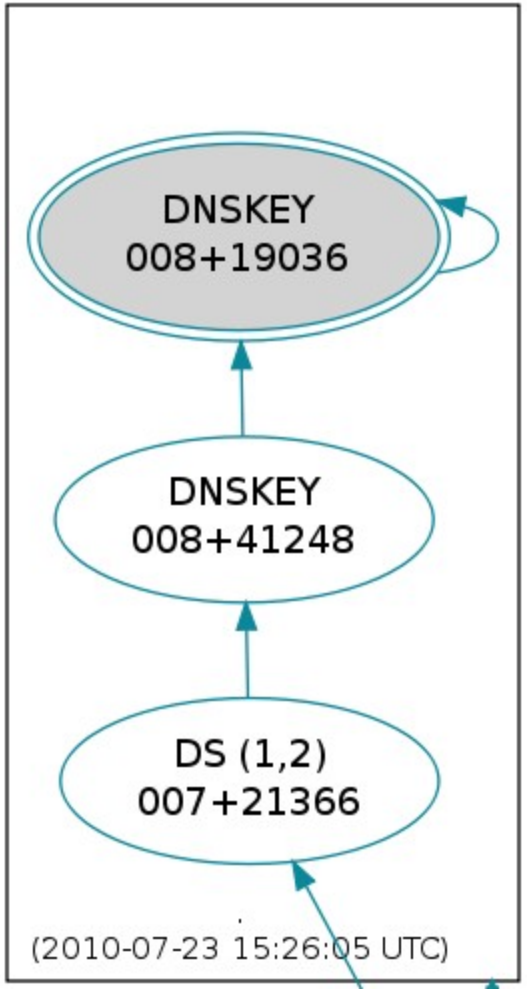
`www.isc.org`

The following slides were created using Sandia National Laboratories "DNSViz"

http://dnsviz.net/

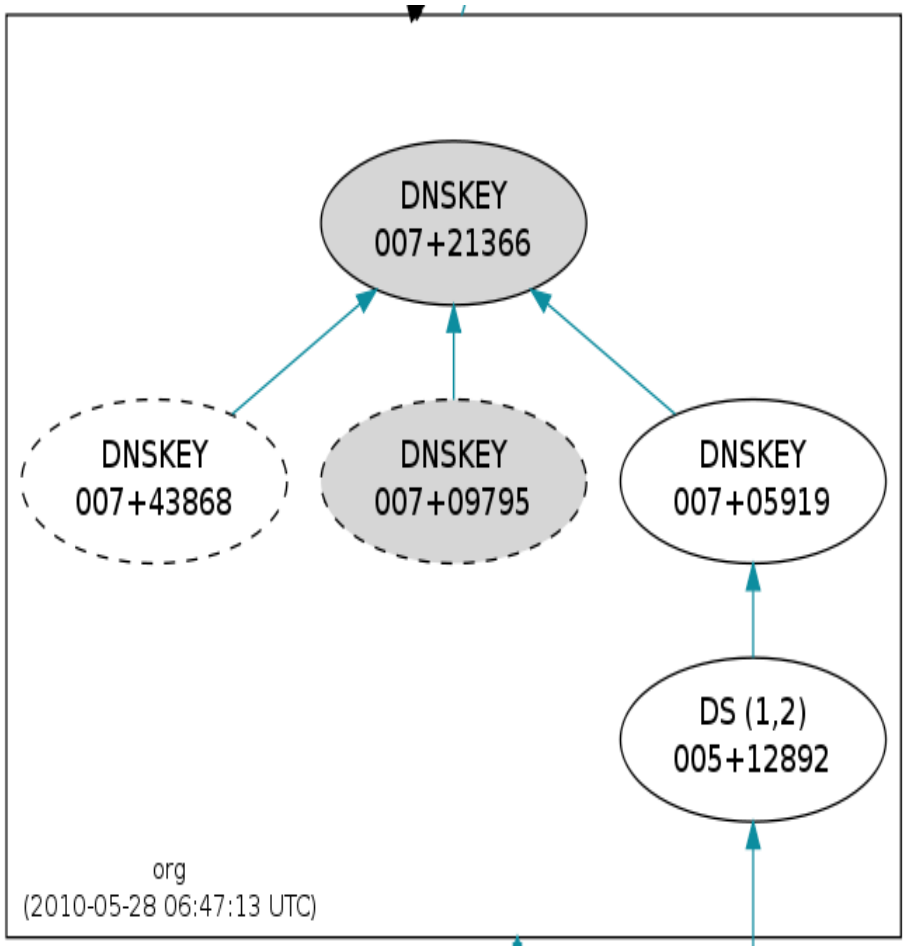
Trusting `isc.org`

- . (root)
  - KSK 19036
  - ZSK 41248
    - Signed w/19036
  - .org `DS` records
    - signed w/ 41248



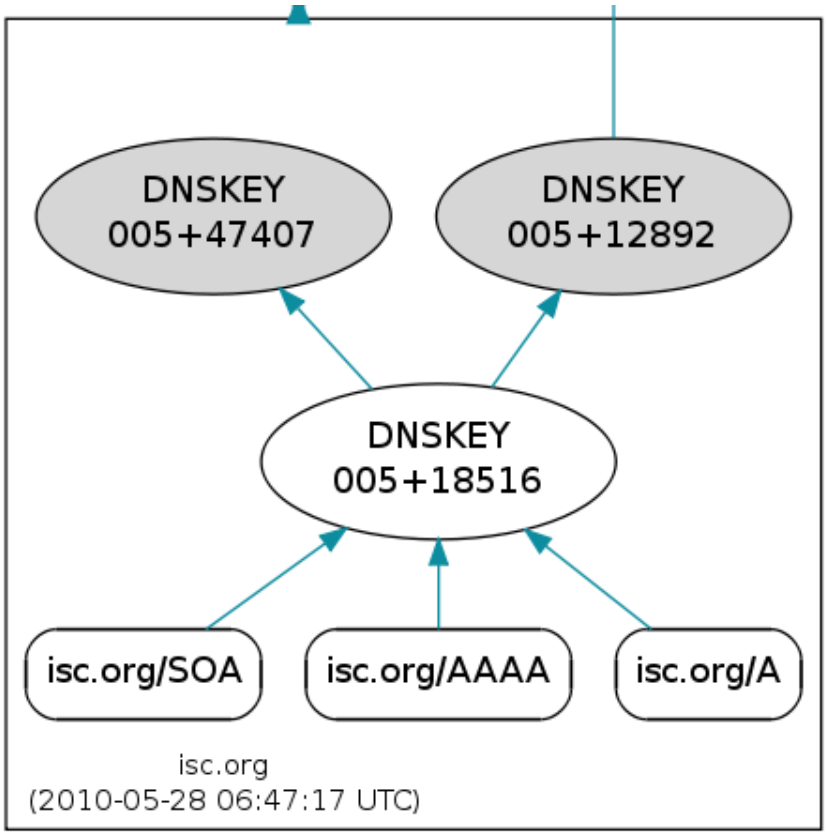
Trusting `isc.org`

- .org
  - KSK 21366
  - ZSK 05919
    - Signed w/21366
  - isc.org `DS` records
    - signed w/ 05919

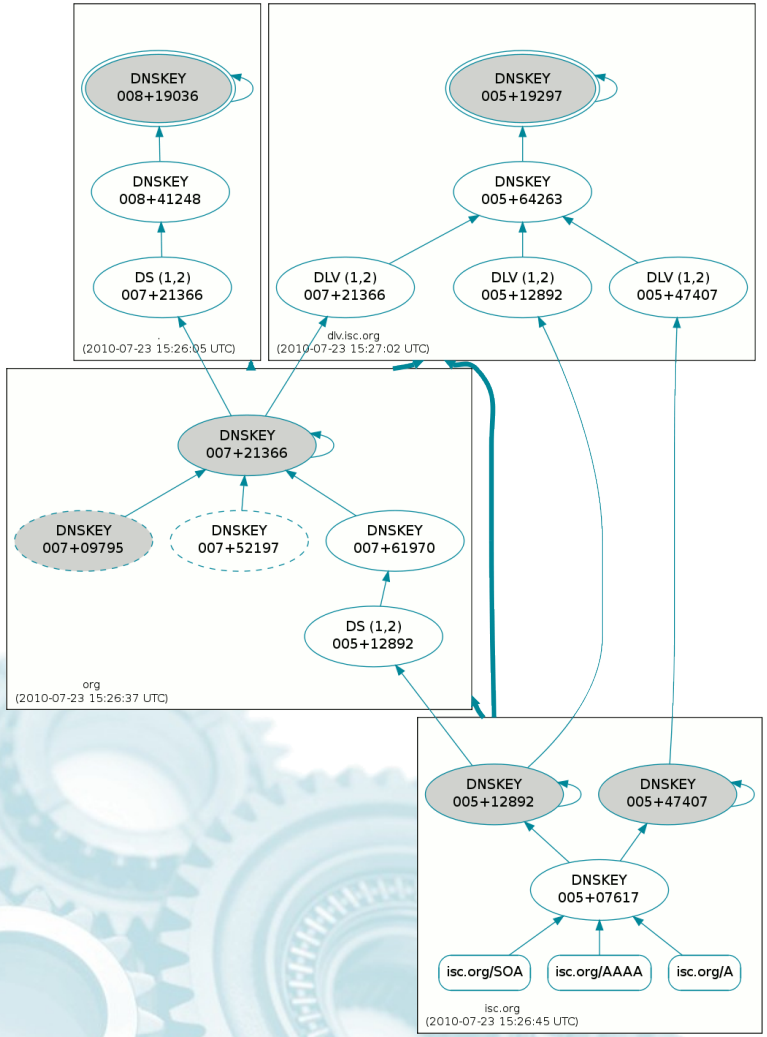


Trusting `isc.org`

- isc.org
  - KSK 12892
    - Hashed into DS
  - ZSK 18516
    - Signed w/ 12892
  - SOA, AAAA, A
    - Signed w/ 18516

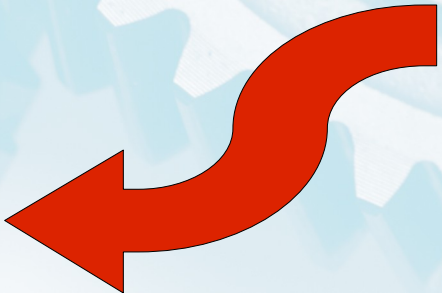


Trusting `isc.org`



- With a trust anchor for root we can trust anything below it that is signed
  - And that has `DS` records in place

DNSSEC Deployment



DNSSEC Deployment

- Generate required keys
  - `dnssec-keygen`
- Insert them into the zone
  - manual (or dynamic)
- Sign zone data
  - `dnssec-signzone` (or dynamic)
- Perform scheduled zone maintenance
  - manual (or dynamic)

DNSSEC Deployment

- `dnssec-keygen`
  - Used to create the required keys
    - Key Signing Key
    - Zone Signing Key

DNSSEC Deployment

- `dnssec-keygen`
  - Defaults algorithm to `RSASHA1`
  - Provides defaults for key size if default algorithm is used:
    - KSK – 2048 bits
    - ZSK – 1024 bits

DNSSEC Deployment

- `dnssec-keygen <zonename>`
- `dnssec-keygen -f KSK <zonename>`

- Produces 2 files per key

`K<zonename>+XXX+YYYY.key`

`K<zonename>+XXX+YYYY.private`

DNSSEC Deployment

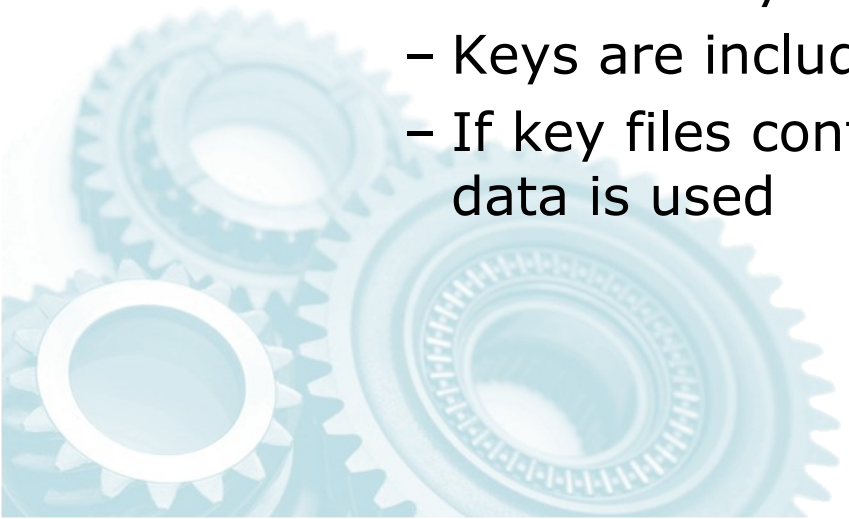
- `dnssec-keygen`
  - Once keys are created, include their public portions (`.key`) into the zone file using standard procedures
  - Keep the `.private` portions secure

DNSSEC Deployment

- `dnssec-signzone`
  - Signs the zone data
    - Creates RRSIG resource records for each authoritative RRset in the zone
    - Transforms zone into "machine generated" file with a `.signed` extension

DNSSEC Deployment

- `dnssec-signzone`
  - BIND 9.7 introduced a new feature..
    - Smart Signing
      - Looks in key repository (directory) for keys
      - Keys are included in zone automatically
      - If key files contain timing meta-data, that timing data is used



DNSSEC Deployment

- `named`
  - New dynamic zone configuration
    - `update-policy local;`
      - Automatically creates "local-only" TSIG key
    - Allows BIND to update without complex configuration

DNSSEC Deployment

- `named`
  - New zone options for dynamic zones
    - `auto-dnssec off;`
      - Default
    - `auto-dnssec allow;`
      - Enables auto-inclusion of keys from repository
      - Enables "`rndc sign`"
    - `auto-dnssec maintain;`
      - Update DNSSEC based on key meta-data

DNSSEC Deployment

- `nsupdate`
  - New option `-l` (ell)
    - Use the named created "local key"
    - Set the `server` address to `localhost`

DNSSEC Deployment

- `rndc`
  - New option `sign`
    - Takes a dynamic zone, searches for keys in the key repository and signs the zone as needed.

Making it work...

```
zone secure.udp53.org {
   type master;
   key-directory "keys";
   update-policy local;
   auto-dnssec maintain;
   file "dynamic/secure.zone";
};
```

Making it work...

```
dnssec-keygen -K /etc/namedb/keys \
          secure.udp53.org
dnssec-keygen -f KSK -K /etc/namedb/keys \
          secure.udp53.org
rndc sign secure.udp53.org
```

Zone is now signed and published

Zone will be automatically re-signed as needed

Making it work...

- Be aware that this automation does NOT deal with `DS` records in the parent or `DLV` records in a registry.

DNSSEC Deployment

- BIND 9.7.2 (currently beta-2)

`new-zone-file` option

- specifies the name of a file to which 'dynamically created' zones are added

`rndc addzone` / `rndc delzone`

- add and remove zones without manually editing `named.conf`

Questions? Comments?

Ready to deploy?