DNSSEC Keys in SmartcardHSM

OpenSC on Mac OS

Luis D Espinoza Sanchez & Eberhard W Lisse

University of Costa Rica & Namibian Network Information Centre

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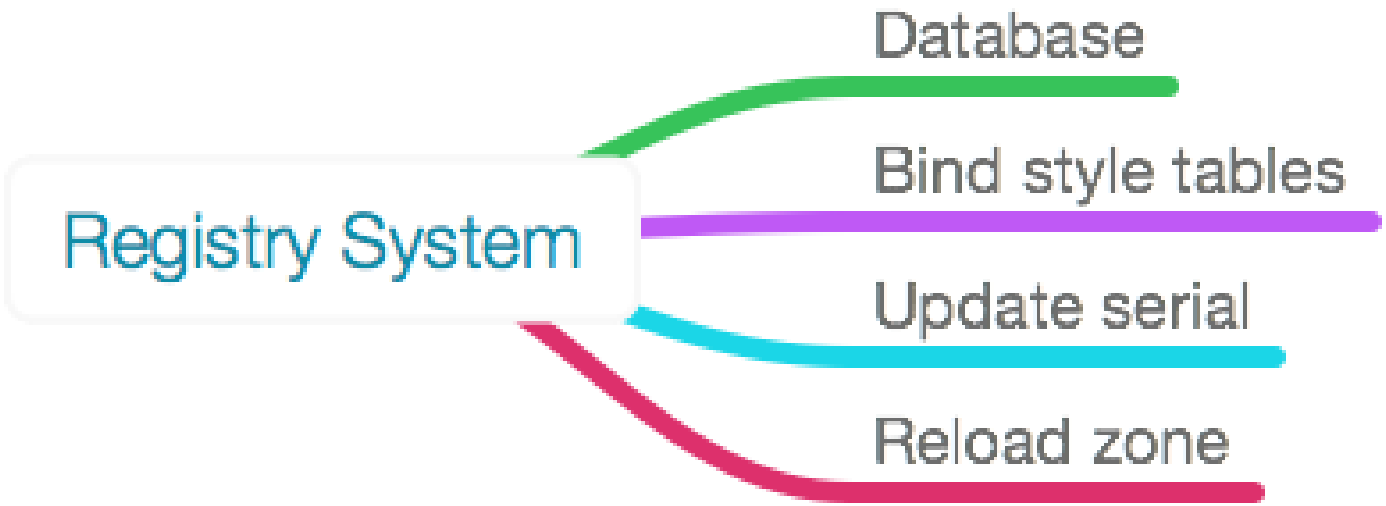
Introduction

- DNSSEC is Easy!
  - Is it Secure?
- Secure DNSSEC is Expensive!
  - Is it really?
- So, what were we looking for?
  - An easy, secure and cheap DNSSEC solution
    - for .NA;
    - for demonstration purposes;
    - for fun (see slide 19)

Introduction

Registry System without DNSSEC

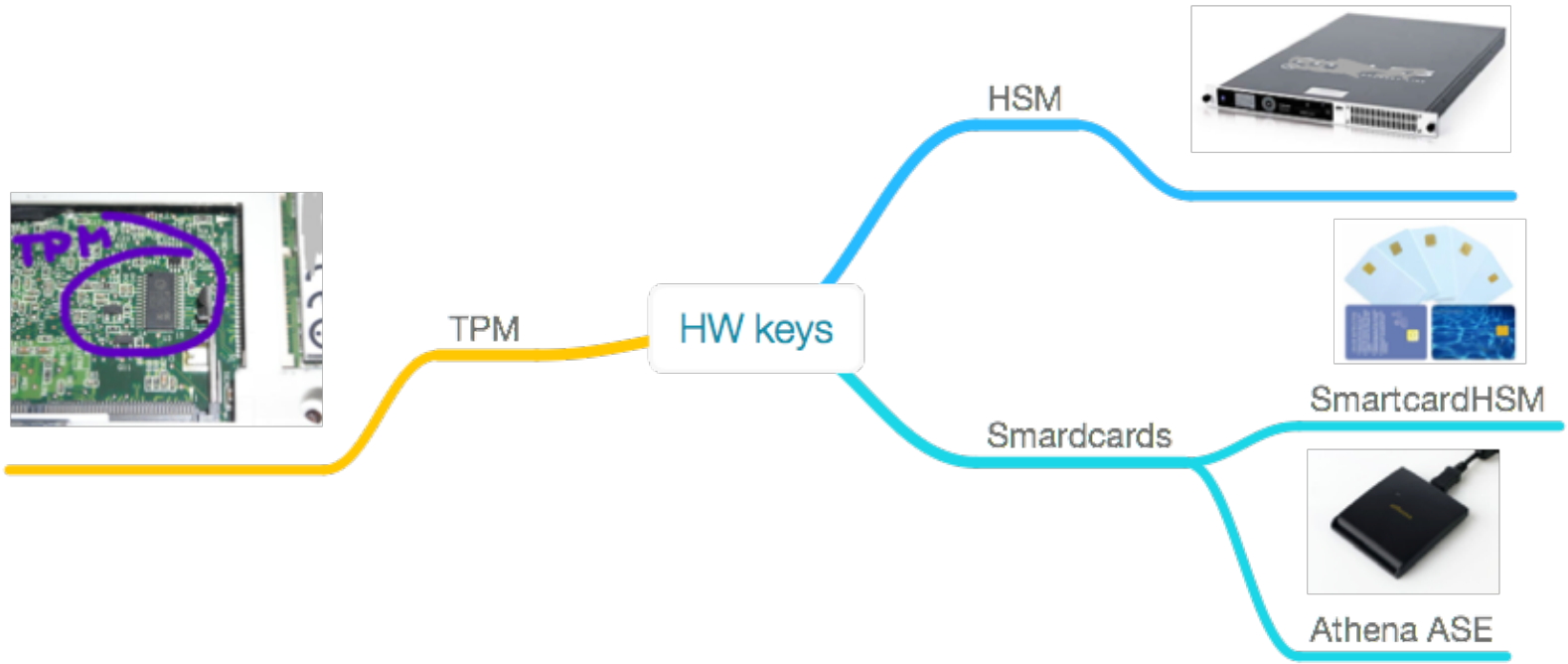


Introduction

Registry System with DNSSEC

Introduction

Hardware Keys



Introduction

Why Mac?

- SmartcardHSM
  - Different Brands
- Smartcard Readers
  - Different Brands
- Open Source Software
  - OpenSC
  - BIND 9
    - Homebrew
    - MacPorts
  - Virtual Box
    - Centos 6
- OS X 10.10.2
  - Native Drivers for the Readers

Proof of Concept

Not Production Grade. Yet.

- Why Mac?
  - Name Servers usually don't run on Netbooks
    - BSD
    - **Ubuntu**
    - Centos
  - It's fun (see slide 19)
- No auditing (Ceremony)
  - Can be added later from Richard Lamb's Ceremony documentation
- Key in Hardware adds some security
  - Physical Access to Server is required
    - Servers are usually in secure data center

Implementation

Bash

- Consolidate Richard Lamb's Ceremony Scripts
  - into 1 single script
  - 50 lines
- dialog
  - to display/modify Environment Variables

Set Environment Variables

Bash

- DATE=‘date -u +%Y%m%d%H%M%S‘
- DOMAIN=na
- PASSWORD=RichardLamb
- PATH=~/Downloads/dccom:$PATH
- PIN1=123456
- PKCS11_LIBRARY_PATH=/Library/OpenSC/lib/opensc-pkcs11.so
- SOPIN="3537363231383830"
- CKALABEL="ksk.""$DOMAIN""."$DATE"

Initialization

Prepare the Card

- sc-hsm-tool –initialize –so-pin $SOPIN \
  –pin $PIN1
  - Erase the Card
- sc-hsm-tool –initialize –so-pin $SOPIN \
  –pin $PIN1 –dkek-shares 2
  - Device Key Encryption Key (DKEK) shares are used to derive the actual keys

Create 2 DKEK Shares

- sc-hsm-tool –create-dkek-share dkek-share-1.pbe \
  –so-pin $SOPIN –pin $PIN1 \
  –password $PASSWORD
- sc-hsm-tool –create-dkek-share dkek-share-2.pbe \
  –so-pin $SOPIN –pin $PIN1 \
  –password $PASSWORD

Import the DKEK Shares

- sc-hsm-tool –import-dkek-share dkek-share-1.pbe \
  –so-pin $SOPIN –pin $PIN1 \
  –password $PASSWORD
- sc-hsm-tool –import-dkek-share dkek-share-2.pbe \
  –so-pin $SOPIN –pin $PIN1 \
  –password $PASSWORD

Generate 2 ZSKs

Why 2?

- dnssec-keygen -r /dev/random -a 8 -b 1024 \ $DOMAIN.
- dnssec-keygen -r /dev/random -a 8 -b 1024 \ $DOMAIN.

Generate KSK Inside the Card

- pkcs11-tool –module $PKCS11_LIBRARY_PATH \
  -l –pin $PIN1 –keypairgen –key-type rsa:2048 \
  –read-object –type pubkey \
  –output-file "$CKALABEL"".pub" \
  –label "$CKALABEL"

Verification

Dump the Card

- pkcs15-tool -D

Wrap the Key

Export and encrypt (wrapped with shares) copy of the private key

- sc-hsm-tool –wrap-key "$CKALABEL"".wrap" \
  –key-reference 1 –pin $PIN1

hcardsign (Bash script)

Generate pre-KSK-signed DNSKEY RRsets for future use

- relies on

  ```
  pkcs11-backup -f$CKALABEL:8:257:$DOMAIN. \
  -S 0 -P $PIN1
  ```

- Open Source (Richard Lamb)
  - Doesn't currently compile on the Mac
  - Will do so RSN
- Not an issue
  - Works on Linux
  - Not required in production
    - Less Safe
- Demonstrated here only to show functionality

Make Backup Card From Wrapped Key

Repeat steps for additional cards

- sc-hsm-tool –initialize –so-pin $SOPIN –pin $PIN1
- sc-hsm-tool –initialize –so-pin $SOPIN \
  –pin $PIN1 –dkek-shares 2
- sc-hsm-tool –import-dkek-share dkek-share-1.pbe \
  –so-pin $SOPIN –pin $PIN1 \
  –password $PASSWORD
- sc-hsm-tool –import-dkek-share dkek-share-2.pbe \
  –so-pin $SOPIN –pin $PIN1 \
  –password $PASSWORD
- sc-hsm-tool –unwrap-key $CKALABEL"".wrap" \
  –key-reference 1 –pin $PIN1

The Real Reason

This is fun!