ICANN

DNSSEC 101

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The Business Case for DNSSEC

- Cyber security is becoming a greater concern to government, enterprises and end users. DNSSEC is a key tool and differentiator.
- DNSSEC is the biggest security upgrade to Internet infrastructure in over 20 years.
- DNSSEC is a critical tool in combating the global nature of cyber crime providing a cross-organizational and trans-national platform for innovative security solutions and authentication.
- DNSSEC infrastructure deployment has been brisk but requires expertise. Getting ahead of the curve is a competitive advantage.

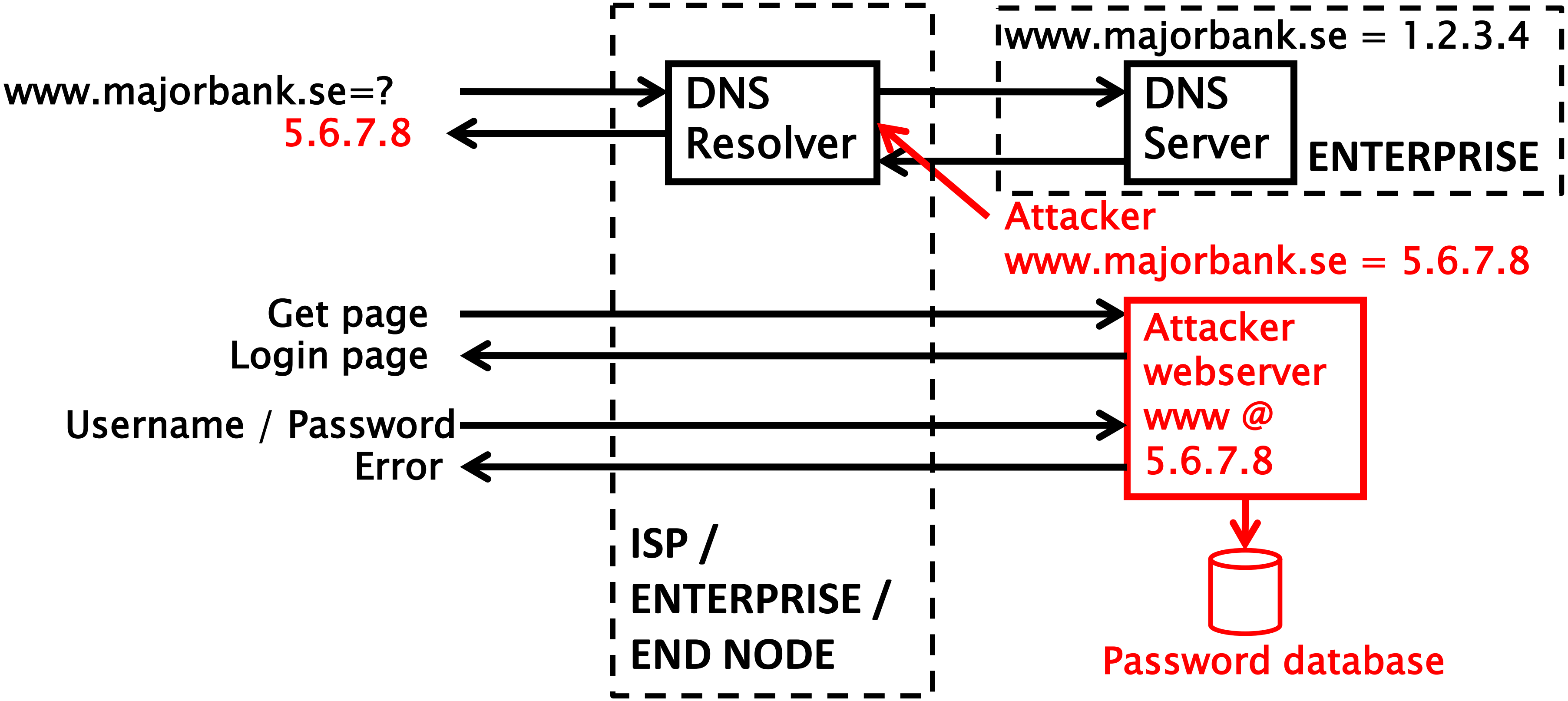
Where DNSSEC fits in

- DNS converts names (www.tata.in) to numbers (64.37.102.54)
- ..to identify services such as www and e-mail
- ..that identify and link customers to business and visa versa

Where DNSSEC fits in

- ..but CPU and bandwidth advances make legacy DNS vulnerable to MITM attacks
- DNS Security Extensions (DNSSEC) introduces digital signatures into DNS to cryptographically protect contents from modification
- With DNSSEC fully deployed a entities can be sure the customer gets un-modified data (and visa versa)

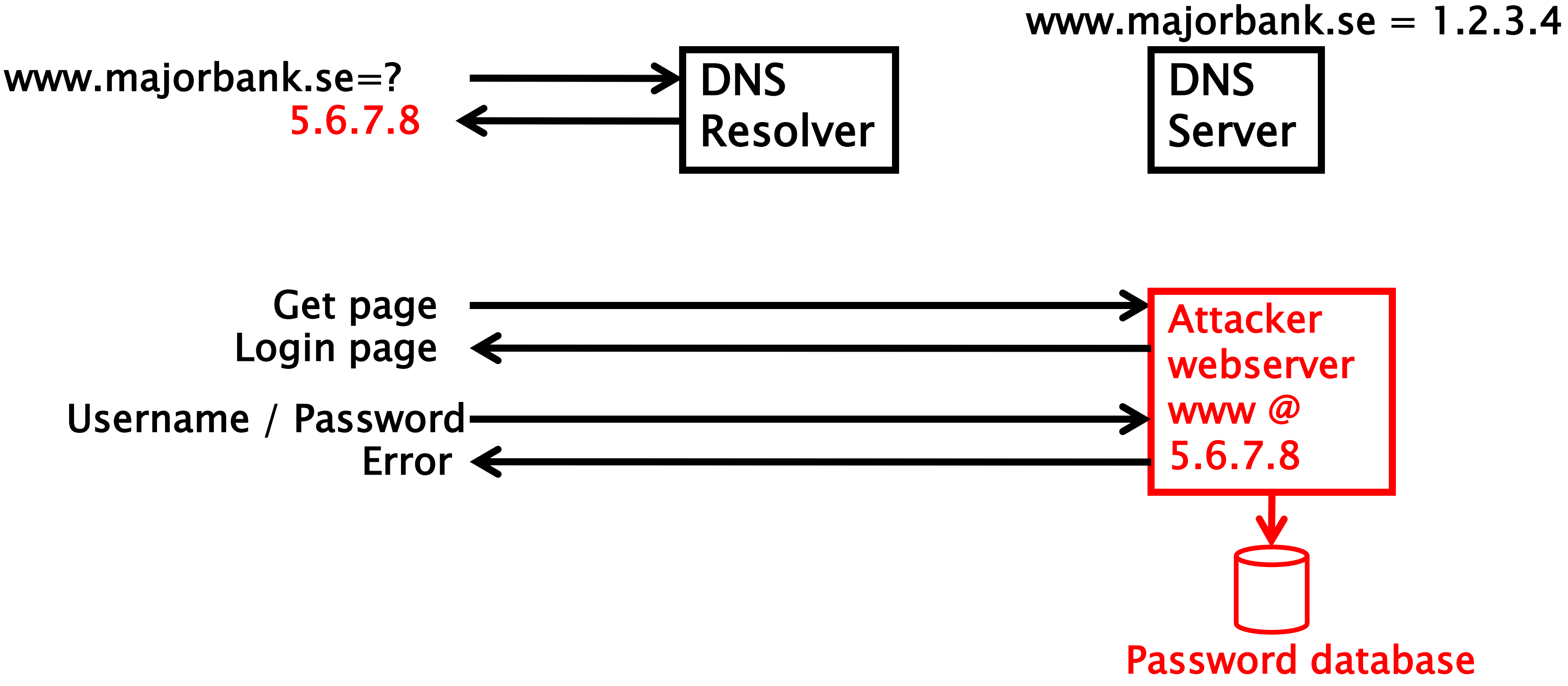
The Original Problem:
DNS Cache Poisoning Attack



Animated slide in .ppt

detailed description at: http://unixwiz.net/techtips/iguide-kaminsky-dns-vuln.html

Argghh! Now all ISP customers get sent to attacker.



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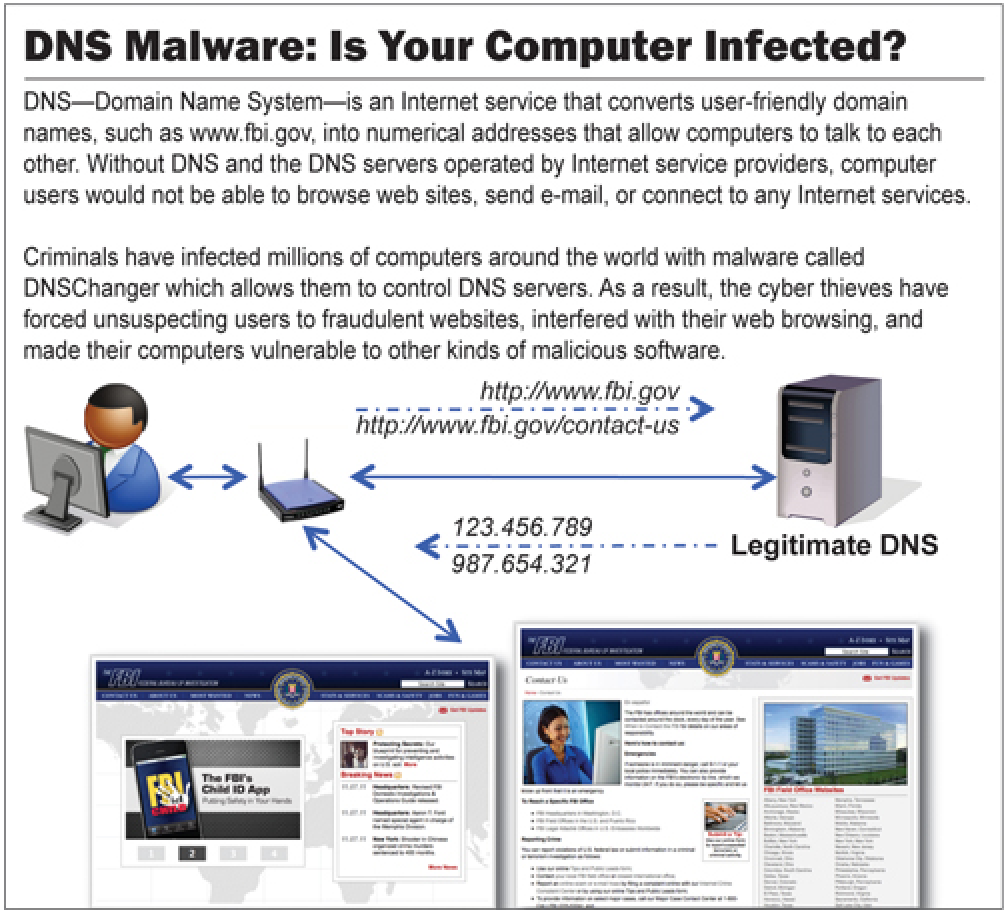
The Bad: DNSChanger - ‘Biggest Cybercriminal Takedown in History’ – 4M machines, 100 countries, $14M



DNS Malware: Is Your Computer Infected?

DNS—Domain Name System—is an Internet service that converts user-friendly domain names, such as www.fbi.gov, into numerical addresses that allow computers to talk to each other. Without DNS and the DNS servers operated by Internet service providers, computer users would not be able to browse web sites, send e-mail, or connect to any Internet services.

Criminals have infected millions of computers around the world with malware called DNSChanger which allows them to control DNS servers. As a result, the cyber thieves have forced unsuspecting users to fraudulent websites, interfered with their web browsing, and made their computers vulnerable to other kinds of malicious software.

Nov 2011 http://krebsonsecurity.com/2011/11/malware-click-fraud-kingpins-arrested-in-estonia/

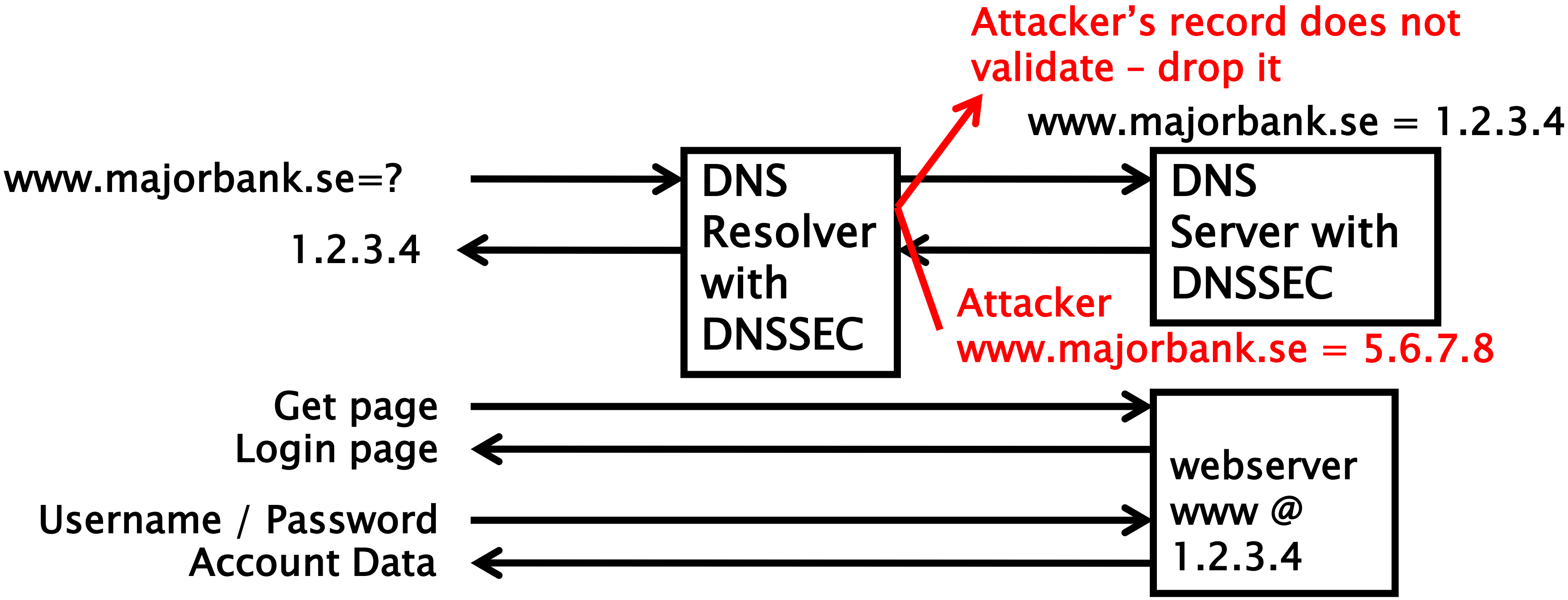
End-2-end DNSSEC validation would have avoided the problems

The Bad: Other DNS hijacks*

- 25 Dec 2010 - Russian e-Payment Giant ChronoPay Hacked
- 18 Dec 2009 – Twitter – “Iranian cyber army”
- 13 Aug 2010 - Chinese gmail phishing attack
- 25 Dec 2010 Tunisia DNS Hijack
- 2009-2012 google.*
  - April 28 2009 Google Puerto Rico sites redirected in DNS attack
  - May 9 2009 Morocco temporarily seize Google domain name
- 9 Sep 2011 - Diginotar certificate compromise for Iranian users
- SSL / TLS doesn't tell you if you've been sent to the correct site, it only tells you if the DNS matches the name in the certificate. Unfortunately, majority of Web site certificates rely on DNS to validate identity.
- DNS is relied on for unexpected things though insecure.

*A Brief History of DNS Hijacking - Google
http://costarica43.icann.org/meetings/sanjose2012/presentation-dns-hijackings-marquis-boire-12mar12-en.pdf

The Good: Securing DNS with DNSSEC



Attacker's record does not validate – drop it

www.majorbank.se = 1.2.3.4

www.majorbank.se=?

1.2.3.4

DNS Resolver with DNSSEC

DNS Server with DNSSEC

Attacker www.majorbank.se = 5.6.7.8

Get page

Login page

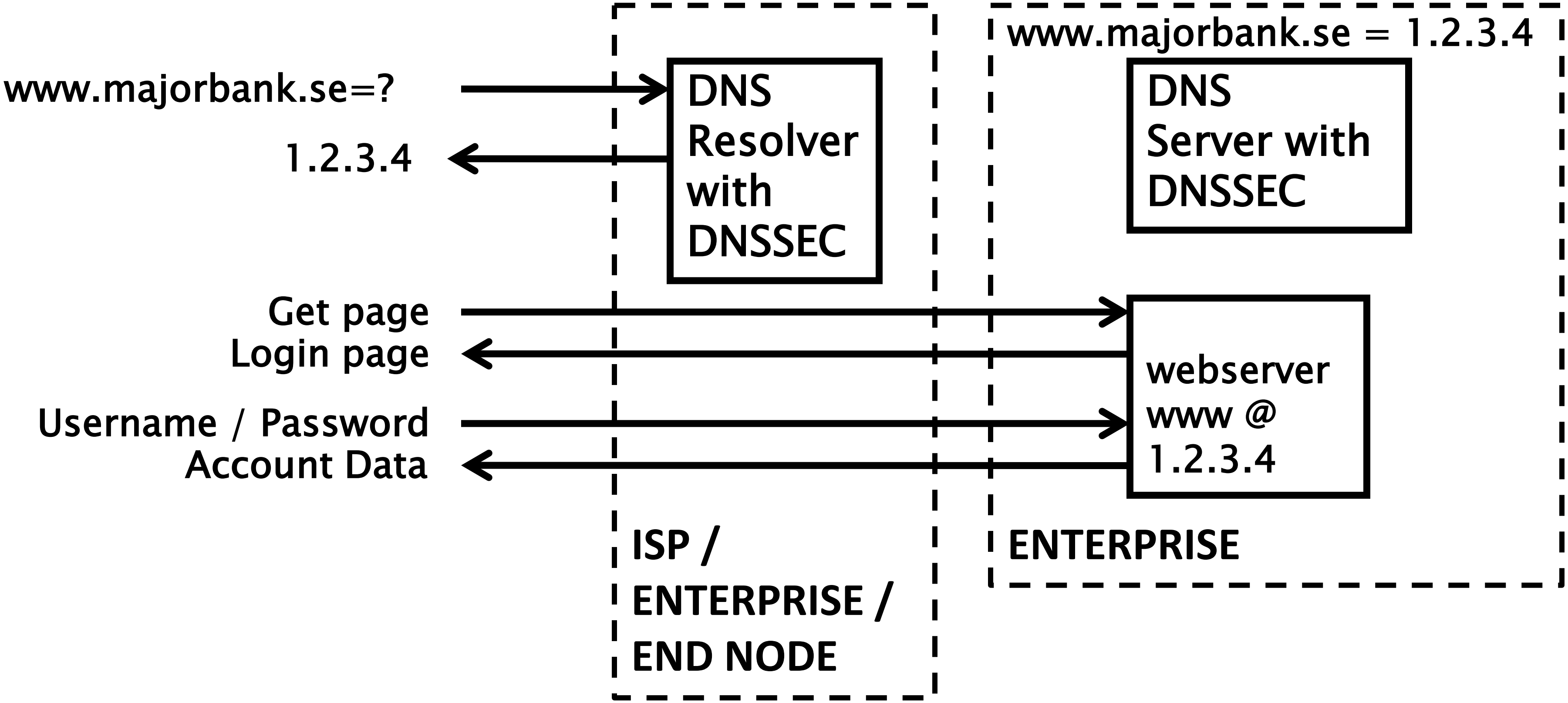
Username / Password

Account Data

webserver www @ 1.2.3.4

Animated slide in .ppt

The Good: Resolver only caches validated records



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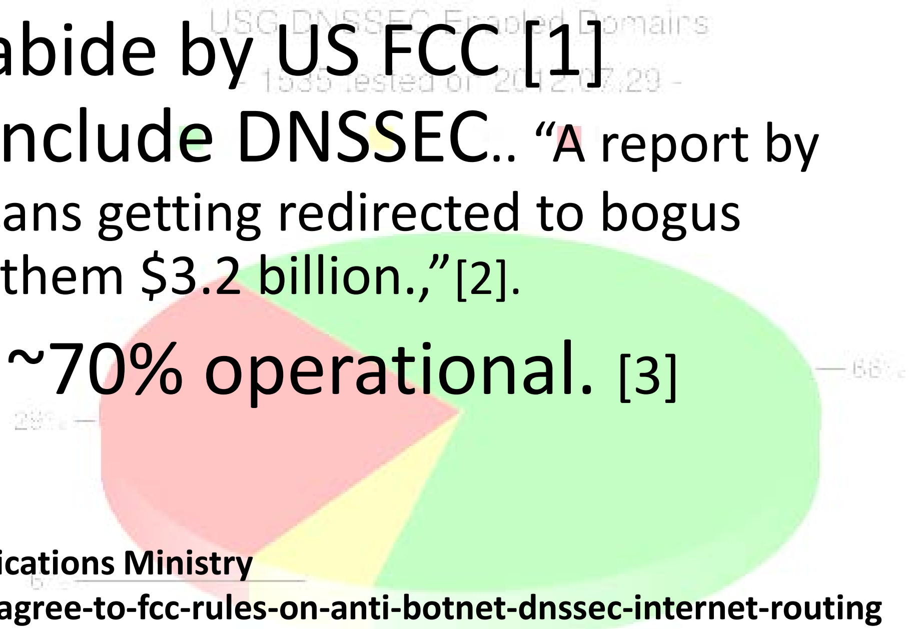
DNSSEC interest from governments

- Sweden, Brazil, Czech Republic and others encourage DNSSEC deployment to varying degrees
- Mar 2012 - AT&T, CenturyLink (Qwest), Comcast, Cox, Sprint, TimeWarner Cable, and Verizon have pledged to comply and abide by US FCC [1] recommendations that include DNSSEC.. "A report by Gartner found 3.6 million Americans getting redirected to bogus websites in a single year, costing them $3.2 billion.,"[2].
- 2008 US .gov mandate. ~70% operational. [3]



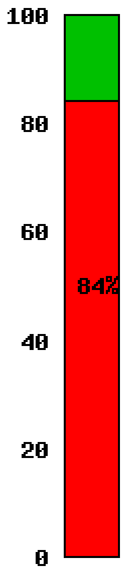
[1] FCC=Federal Communications Commission=US communications Ministry

[2] http://securitywatch.pcmag.com/security/295722-isps-agree-to-fcc-rules-on-anti-botnet-dnssec-internet-routing

[3] http://www.whitehouse.gov/sites/default/files/omb/memoranda/fy2008/m08-23.pdf

DNSSEC: Where we are

- Deployed on 95/316 TLDs (.br, .cz, .co, .ua, .nl, .bg, .kg, .am, .lv, .ug, .mm, .mn, .de, .eu, .uk, .tt, .pl, .in, .lk, .com, .my مليسيا , .asia, .tw 台灣, .kr 한국, .jp, .fr, .post, …)
- Root signed** and audited
- New gTLDs require it
- >84% of domain names could have DNSSEC
- Growing ISP support*
- 3rd party signing solutions: GoDaddy, Binero, VeriSign…***
- Vendors support it: ISC/Bind, Microsoft, …
- New standards being developed on DNSSEC (e.g., IETF RFC6698 SSL Certificates)
- Growing interest from others major players…

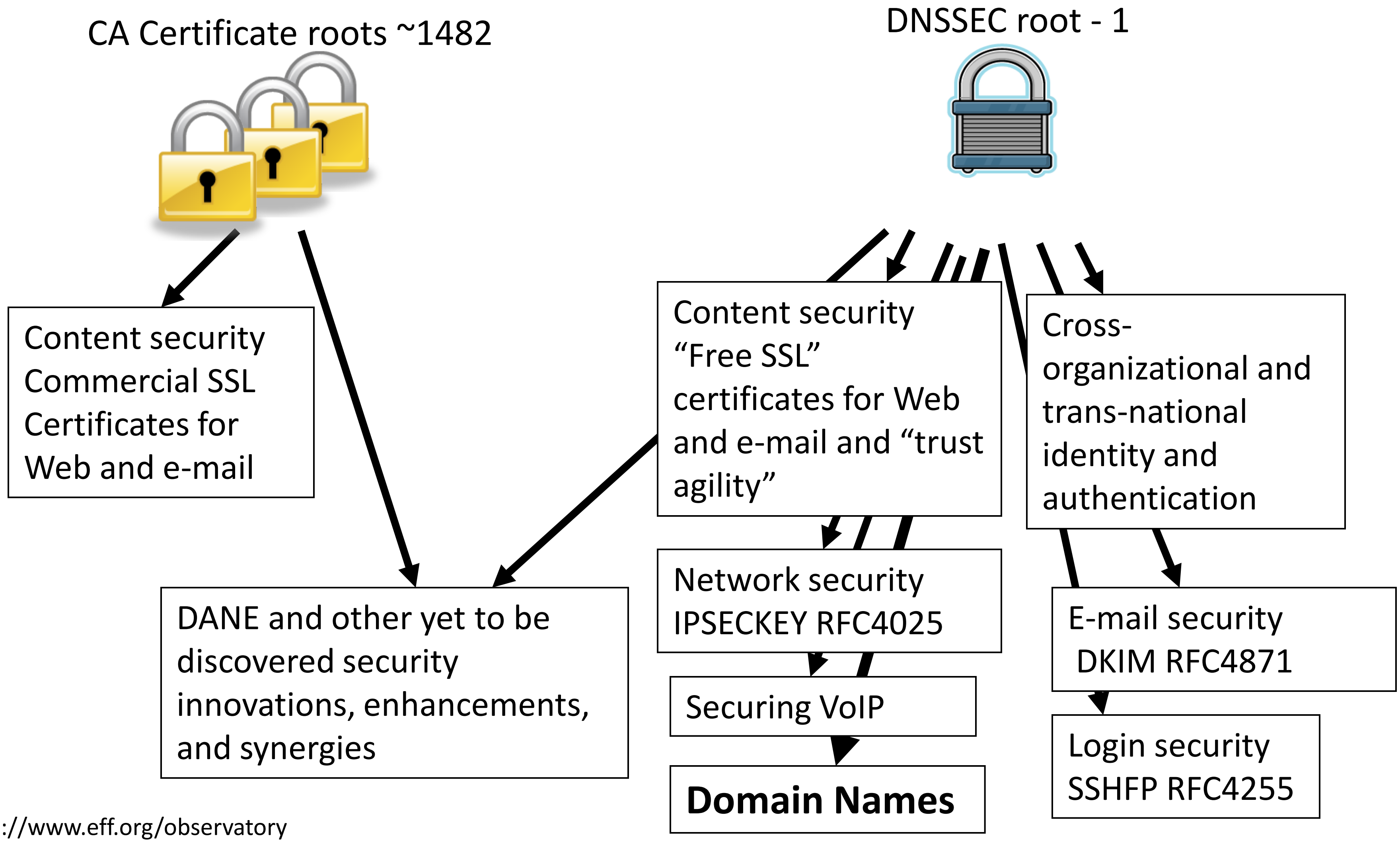


***COMCAST Internet (18M), TeliaSonera SE, Sprint,Vodafone CZ,Telefonica CZ, T-mobile NL, SurfNet NL, SANYO Information Technology Solutions JP, others..**

****21 TCRs from: TT, BF, RU, CN, US, SE, NL, UG, BR, Benin, PT, NP, Mauritius, CZ, CA, JP, UK, NZ**

***** Partial list of registrars: https://www.icann.org/en/news/in-focus/dnssec/deployment**

The Bad: SSL Dilution of Trust
The Good: DNSSEC = Global “free” PKI



CA Certificate roots ~1482

DNSSEC root - 1

Content security
Commercial SSL
Certificates for
Web and e-mail

DANE and other yet to be discovered security innovations, enhancements, and synergies

Content security
“Free SSL” certificates for Web and e-mail and “trust agility”

Cross-organizational and trans-national identity and authentication

Network security
IPSECKEY RFC4025

Securing VoIP

Domain Names

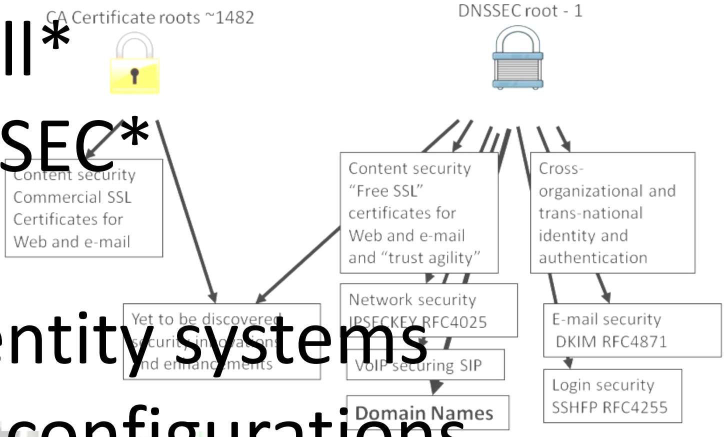
E-mail security
DKIM RFC4871

Login security
SSHFP RFC4255

https://www.eff.org/observatory
http://royal.pingdom.com/2011/01/12/internet-2010-in-numbers/

Opportunity: New Security Products

- Improved Web SSL and certificates for all*
- Secured e-mail (S/MIME) for all*
- Validated remote login SSH, IPSEC*
- Securing VoIP
- Cross organizational digital identity systems
- Secured content delivery (e.g. configurations, updates, keys)
- Securing Smart Grid efforts
- A global PKI
- Increasing trust in e-commerce



CA Certificate roots ~1482

DNSSEC root - 1

Content security Commercial SSL Certificates for Web and e-mail

Content security “Free SSL” certificates for Web and e-mail and “trust agility”

Cross-organizational and trans-national identity and authentication

Yet to be discovered security innovations and enhancements

Network security IPSECKEY RFC4025

VoIP securing SIP

Domain Names

E-mail security DKIM RFC4871

Login security SSHFP RFC4255

A good ref http://www.internetsociety.org/deploy360/dnssec/

*IETF standards complete or currently being developed RFC6698

+1-202-709-5262
VoIP

US-NSTIC effort

DNS is a part of all IT ecosystems

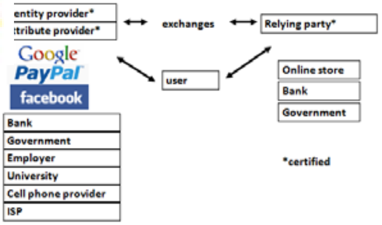
Google

OpenID

facebook

ebay

AADHAAR

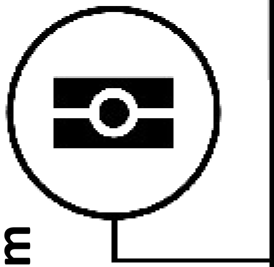


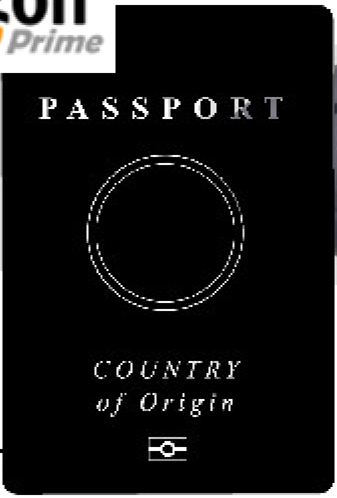
PayPal™

OECS ID effort

amazon Prime

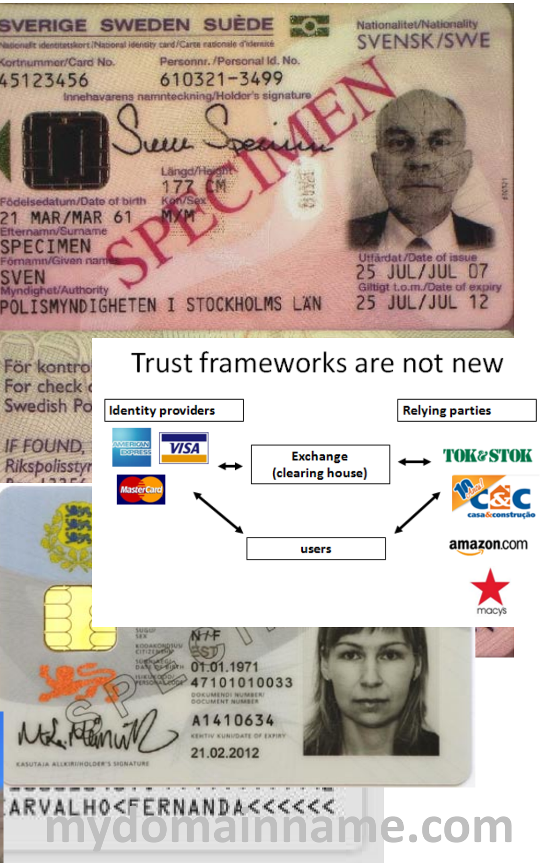
e-Passport symbol





ICP Brasil

O Brasil na era da certificação digital



Trust frameworks are not new

DigiNotar®

A VASCO COMPANY

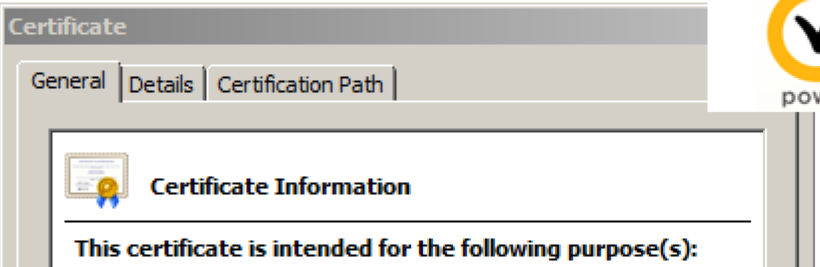
COMODO

Creating Trust Online®

Smart Electrical Grid

Norton SECURED

powered by VeriSign



Certificate

General | Details | Certification Path

Certificate Information

This certificate is intended for the following purpose(s):

mydomainname.com

lamb@xtcn.com

DNSSEC: Classic bottom-up, multi-stakeholder built Internet infrastructure upgrade to help address today’s needs and create tomorrow’s opportunity.

DNSSEC @ the root: A bottom-up, multi-stakeholder operation

Community driven

- Listened to calls from global community for deployment:
  - Internet community (e.g., RIPE, APNIC, ccNSO…)
  - Governments
  - Business (e.g., Kaminsky 2008, Press)

Deploying it

- Problem
  - Bureaucracy and Fear: Hard to change anything that has not changed since 1983. Many excuses not to.
  - root - An internationally agreed to single key – right
  - Trust me - I will manage the root key. ..uh huh.

Approach

- Eliminate excuses and lead by example – start at root
- Solution
  - Multi-stakeholder – get buy in up front
  - Bottom up – like the Internet itself
  - Transparency and Choice
  - Draw from existing secure practices and trusted models

DNSSEC at the root: result

- Deployed 15 July 2010
- Completed in ~2years
- Biggest upgrade to the Internet’s core infrastructure in 20 years
- Set the stage for deployment in rest of hierarchy (e.g., top level domains, end user domains)

Cont…

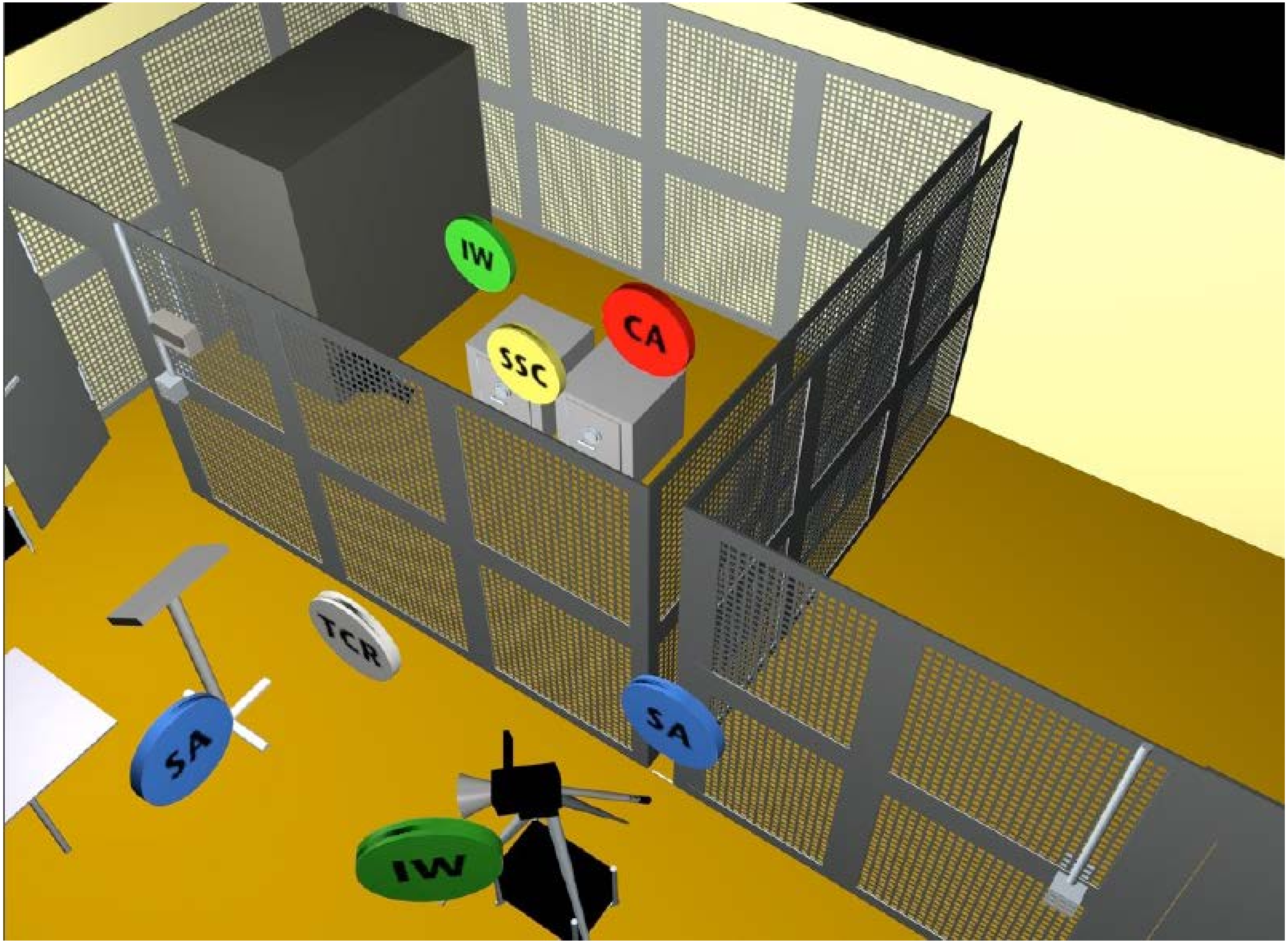
- Got global buy in
- Direct stakeholder participation in key management – 21 Trusted Community Representatives made up of respected members of Internet community from 18 countries
  - Currently: URUGUAY, BRAZIL, TRINIDAD AND TOBAGO, CANADA, BENIN, SWEDEN, NEPAL, NETHERLANDS, NEW ZEALAND, RUSSIAN FEDERATION, PORTUGAL, JAPAN, MAURITIUS, CHINA, BURKINA FASO,CZECH REPUBLIC, UNITED KINGDOM, USA

Cont….

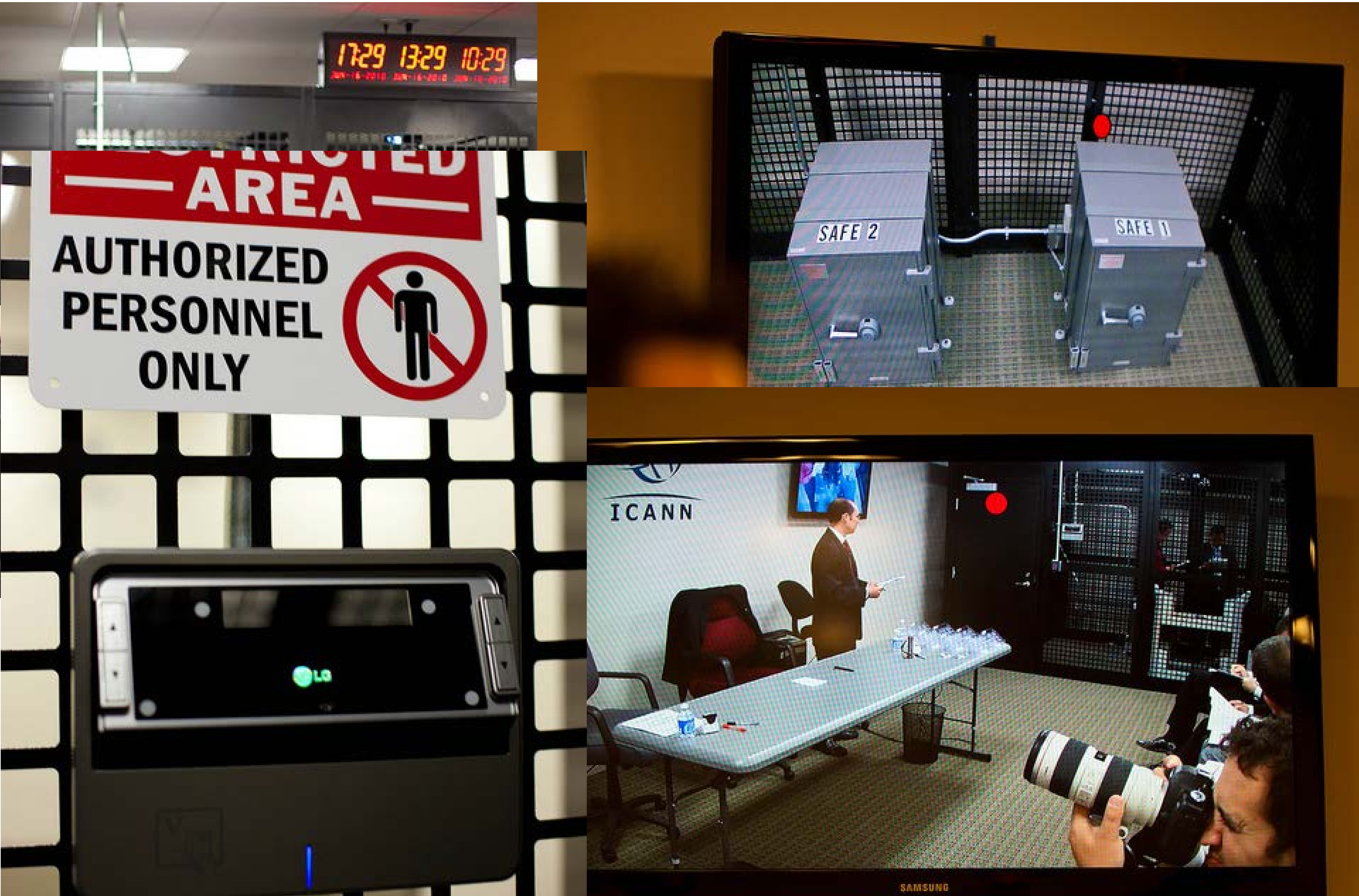
- Enabled DNSSEC deployment throughout hierarchy – need just one key to validate all
- Publish, broadcast everything.
- Pass 3rd party annual SysTrust audit
- ICANN Secure Key Management Facilities in Culpepper, VA and El Segundo, CA. FIPS 140-2 Level 4 crypto, GSA Class 5 safes, multiple tiers, biometrics, etc.

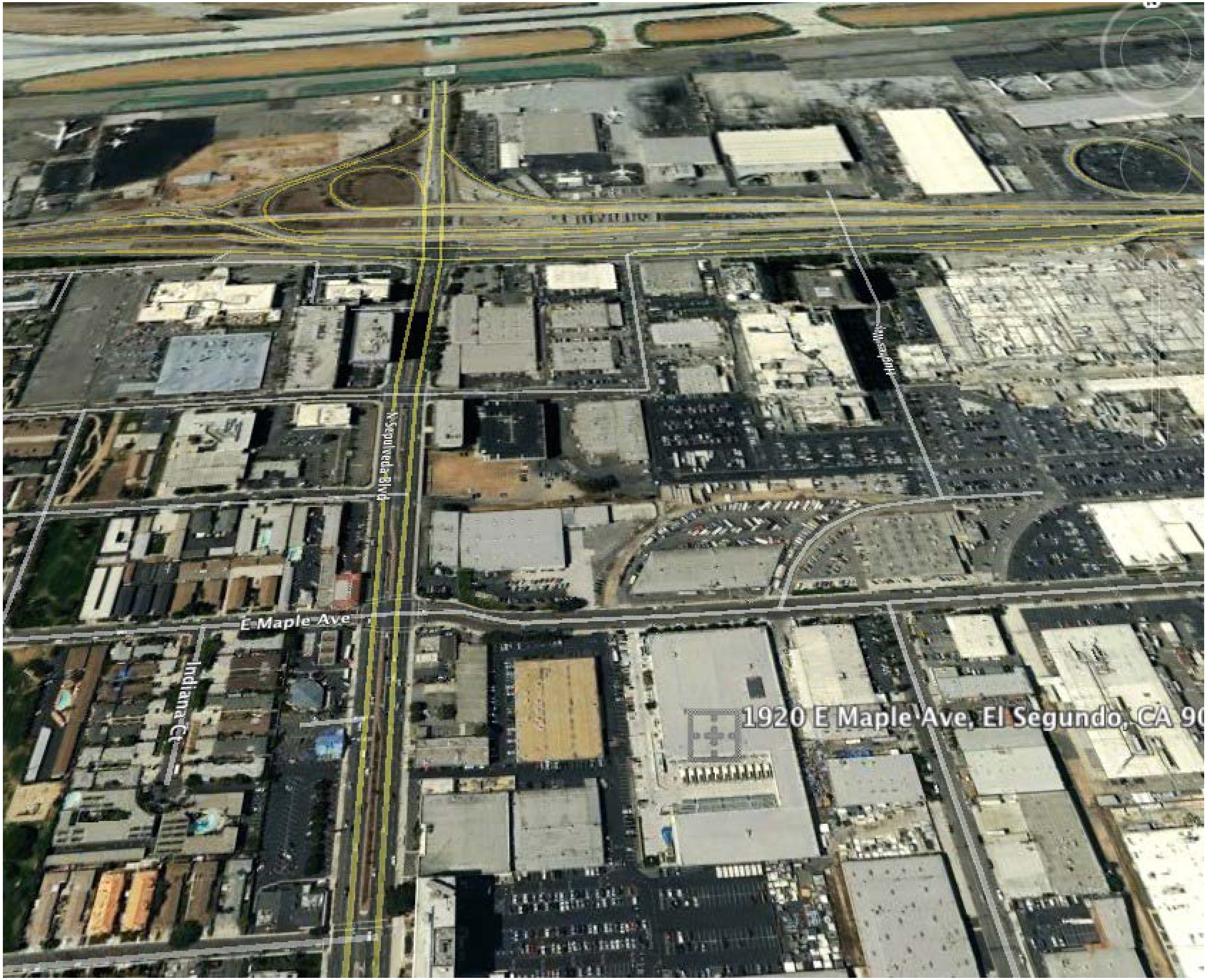
SysTrust

See root-dnssec at http://dns.icann.org/


IW
CA
SSC
TCR
SA
SA
IW

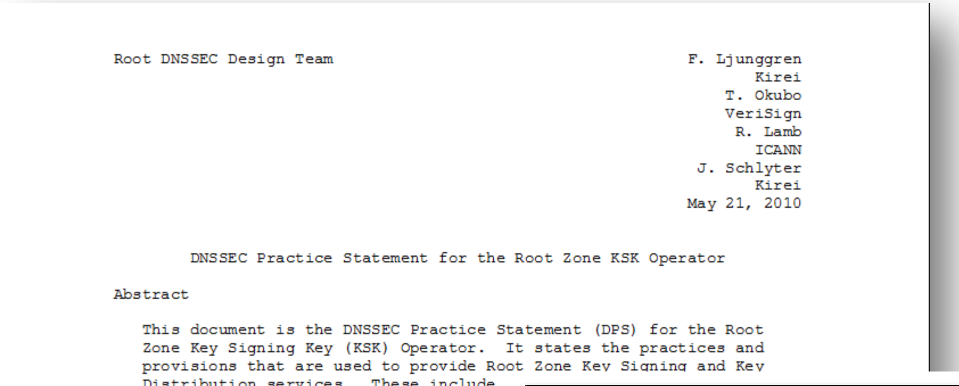
http://www.flickr.com/photos/kjd/sets/72157624302045698/




N Sepulveda Blvd
E Maple Ave
Indiana Ct
1920 E Maple Ave, El Segundo, CA 90

January 27, 2010

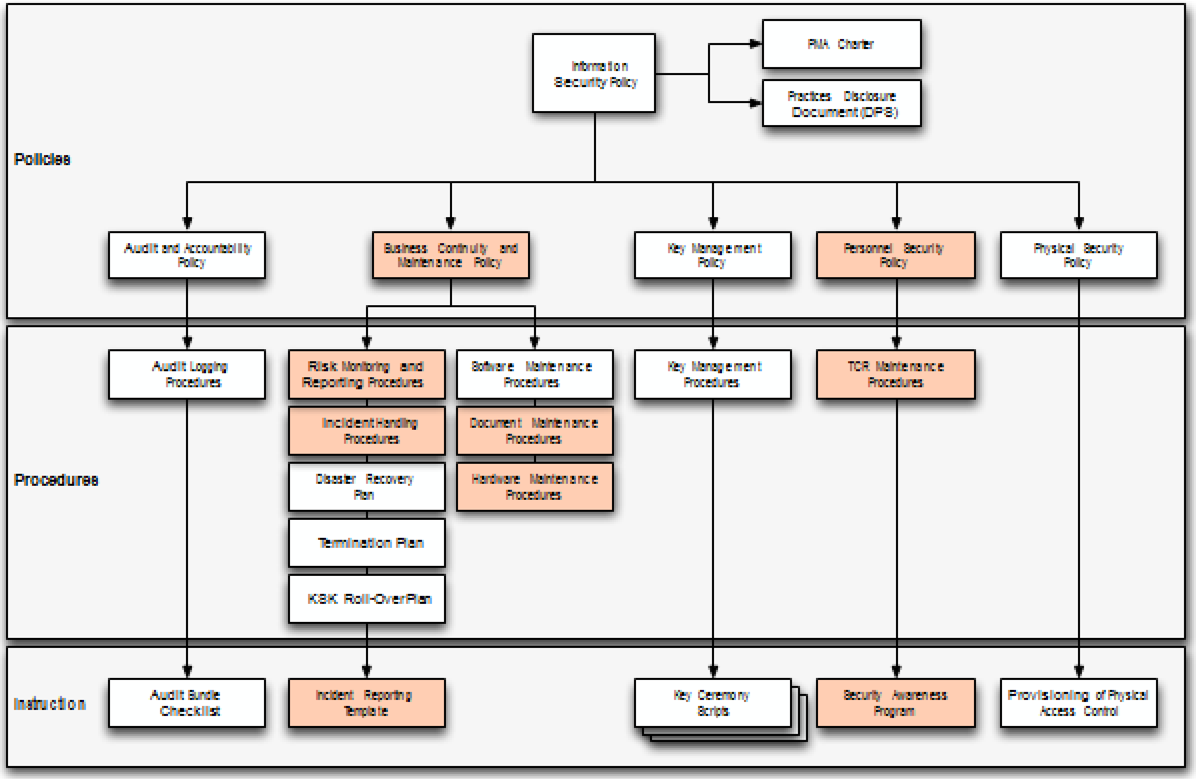
Documentation - Root



```
Root DNSSEC Design Team                                    F. Ljunggren
                                                                  Kirei
                                                               T. Okubo
                                                               VeriSign
                                                                R. Lamb
                                                                  ICANN
                                                            J. Schlyter
                                                                  Kirei
                                                           May 21, 2010


      DNSSEC Practice Statement for the Root Zone KSK Operator

Abstract

   This document is the DNSSEC Practice Statement (DPS) for the Root
   Zone Key Signing Key (KSK) Operator.  It states the practices and
   provisions that are used to provide Root Zone Key Signing and Key
   Distribution services.  These include,
   issuing, managing, changing and distrib
   with the specific requirements of the U

Copyright Notice

   Copyright 2009 by VeriSign, Inc., and b
   Assigned Names and Numbers.  This work
```

91 Pages and tree of other documents!

Root DPS


Information Security Policy
RMA Charter
Practices Disclosure Document (DPS)
Policies
Audit and Accountability Policy
Business Continuity and Maintenance Policy
Key Management Policy
Personnel Security Policy
Physical Security Policy
Procedures
Audit Logging Procedures
Risk Monitoring and Reporting Procedures
Software Maintenance Procedures
Key Management Procedures
TCR Maintenance Procedures
Incident Handling Procedures
Document Maintenance Procedures
Disaster Recovery Plan
Hardware Maintenance Procedures
Termination Plan
KSK Roll-Over Plan
Instruction
Audit Bundle Checklist
Incident Reporting Template
Key Ceremony Scripts
Security Awareness Program
Provisioning of Physical Access Control

NOTICE
ALL EMPLOYEES AND VISITORS MUST WEAR IDENTIFICATION BADGES
NOTICE
NOTICE
UNAUTHORIZED PERSONS NOT PERMITTED BEYOND THIS POINT
NOTICE
NOTICE
NO FOOD OR DRINK BEYOND THIS POINT
ICANN
SEASTROM
3066
SAFE 2
SAFE 1
EXIT
ICANN
ANN
One World. One Internet. Everyone Connected.
19036

```
Starting: Keygen (at Wed Jun 16 21:29:00 2010 UTC)
Use HSM /opt/dnssec/aep.hsmconfig?
Activate HSM prior to accepting in the affirmative!! (y/N): y

HSM /opt/dnssec/aep.hsmconfig activated.
[debug] setenv KEYPER_LIBRARY_PATH=/opt/dnssec
[debug] setenv PKCS11_LIBRARY_PATH=/opt/Keyper/PKCS11Provider/pkcs11.GCC4
.0.2.so.4.07
Found 1 slots on HSM /opt/Keyper/PKCS11Provider/pkcs11.GCC4.0.2.so.4.07
HSM slot 0 included
Loaded /opt/Keyper/PKCS11Provider/pkcs11.GCC4.0.2.so.4.07 Slot=0
HSM Information:
    Label:            ICANNKSK
    ManufacturerID:   AEP Networks
    Model:            Keyper Pro 0405
    Serial:           [illegible]

Generating 2048 bit RSA keypair...
```

Summary

DNSSEC multi stakeholder effort from start and at root is a concrete operational example of how successful the bottom-up multi-stakeholder approach can be.