

Securing DNS Infrastructure Using DNSSEC

Ram Mohan

Executive Vice President, Afilias

rmohan@afilias.info

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Agenda

- Getting Started
 - Finding out what DNS does for you
 - What Can Go Wrong
- A Survival Guide to DNSSEC
 - Why Techies Created DNSSEC
 - What Can Happen Without DNSSEC
- Why Should Anyone Care
 - Consequences
 - Responsibilities of Network Operators (ISPs), Registrars, Registries, Root Operators, ICANN and others
- The Road Ahead
 - Signing the root
 - What domain name owners can do
- Q&A Session



What the DNS is used for

- Web, Email, Streaming Media, Instant Messaging – the Internet depends on the DNS
 - DNS decides if your site can be reached
 - DNS determines if your email can be delivered
- DNS is the Internet directory and phone book
 - Provides directions on where computers are for each domain name
- DNS Prevents Outages and Provides Redundancy
 - DNS mismanagement can result in “Internet outages” even if your Internet connection is working

What Does The DNS Do For You

- Tells machines where to go when you:
 - Type in a web address
 - Send an email



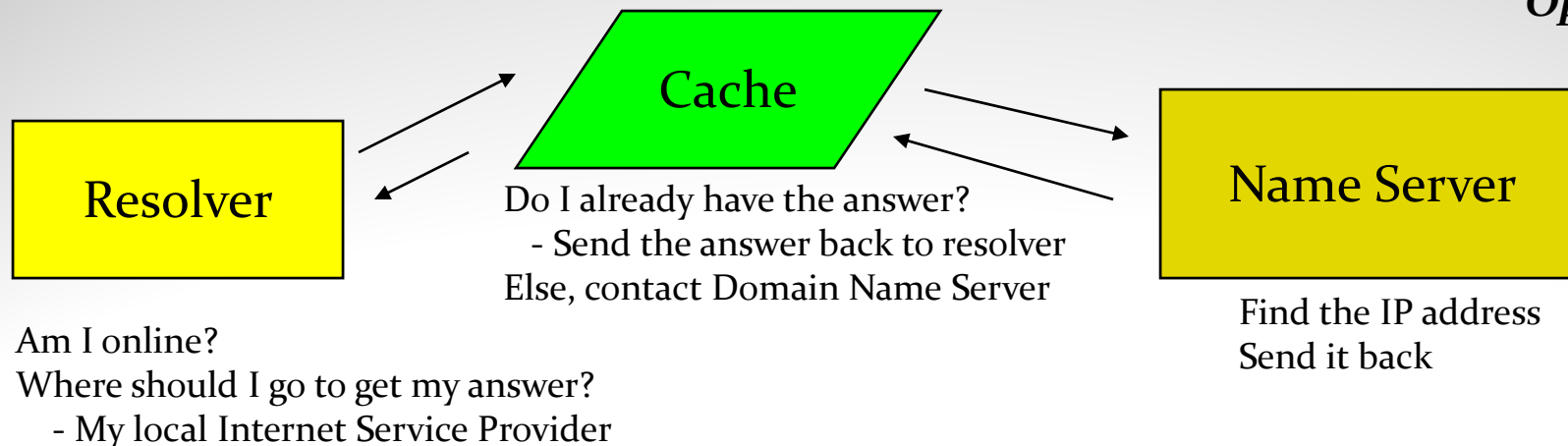
User



ISP



Name Server Operators



Why Attack the DNS

- **Money**
 - Lot of money waiting to be made (stolen) when ecommerce and banking is compromised
- **Power**
 - ISPs, Network operators and the Danish Internet user can be hijacked and forcibly redirected
 - Reduces credibility and erodes trust
- **Control**
 - Allows spying on users without their knowledge or control

What Can Go Wrong



- Forgery
 - The DNS data being returned to your ISP can be forged
 - Especially easy on a wireless network
 - Result: You are transported where you did not mean to go
- Poisoning
 - The DNS data can be modified
 - Causes your ISP's cache to have valid but wrong information on where to go
- Eavesdropping
 - Can intercept your DNS data and just "listen" before passing on
- Other things that can go wrong:
 - Alteration of zone data - Impersonation of master/cache - Unauthorized updates

2005 ISP Attack

- In March-April 2005, users of an ISP had specific spyware, spam and pay-per-click trojans, from redirection sites
- The ISP's cache had hundreds of DNS names spoofed...
 - AmericanExpress.com
 - FedEx.com
 - CitiCards.com
 - DHL-USA.com
 - Sabre.com

Source: Allison Mankin

The Kaminsky Attack

- July 2008 - researcher Dan Kaminsky discloses evidence of massive Internet vulnerability
 - Easy “cache poisoning”
 - Exposes all recursive DNS resolvers to takeover
- Allows all Internet traffic to be hijacked on compromised DNS resolvers
 - Less than one second to compromise a vulnerable server
 - Completely transparent to Internet user

Worldwide critical problem: DNS vendors and other companies issued emergency patches

What Did The Attack Allow

- 1) Break past most username/password prompts on websites, no matter how the site is built.
- 2) Break the Certificate Authority system used by SSL, because Domain Validation sends an email and email is insecure.
- 3) Expose the traffic of SSL VPNs, because the certificate check is now circumvented
- 4) Force malicious automatic updates to be accepted
- 5) Cause millions of lines of totally untested network code to be exposed to attack
- 6) Leak TCP and UDP connectivity behind the firewall, to any website, in an attack we thought we already fixed *twice*
- 7) Expose the traffic of tools that don't even pretend to be secure, because "it's behind the firewall" or "protected by a split-tunneling IPsec VPN".

DNSSEC Explained



- DNSSEC is the Internet's answer to DNS Identity Theft
 - It protects users from DNS attacks
 - It makes systems detect DNS attacks
- Almost everything in DNSSEC is digitally signed
 - Allows authentication of the ORIGIN of the DNS data
 - Ensures INTEGRITY of the DNS data
- Digitally signed = "Public Key Cryptography"
 - Secret Private Key, Open Public Key
 - DNS Messages are scrambled using the Private Key – the Public Key is needed to unscramble it [a.k.a. "SIGNING"]
 - You now know WHO sent the message (since private key is unique)
- If data is MODIFIED, mangled, or otherwise compromised en-route...
 - The signature is no longer valid

- DNSSEC = DNS Security Extensions

The Chain of Trust

If I trust a public key from someone, I can use that key to verify the signature ... and authenticate the source

- Make sure the root zone key can be trusted
 - Pointers in the root zone point to lower zones (com/org/info/de etc)
 - Each pointer is validated with the previous validated zone key
- Only the key for the root zone is needed to validate all the DNSSEC keys on the Internet
- How to update these keys and propagate them are not done yet

Technical Details behind DNSSEC

- **AUTHENTICATES** every set of DNS data – this is called a DNS Resource Record set, or RRs
 - (A records, MX records, DNAMEs, etc, etc)
- Authenticates **absence** of DNS data
 - xyz.icann.org does not exist
- Creates four **new** DNS record types
- Validates using **Chain Of Trust**
- **Each** answer is signed
- DNSSEC:
 - Provides no CONFIDENTIALITY of DNS data
 - No protection against Denial of Service attacks
- SSL, IPsec are not enough

Roles and Responsibilities

- Registrars, network operators, registries, ICANN, root server operators ... large network must coordinate and interact
- Create DNSSEC Capable Name Servers for the TLD and lower level zones
- Put policies together
 - Zone walking
- How to handle key rollover
 - How can you ensure that when the key has to be changed, it is propagated securely, safely, and quickly?

DNSSEC Trust Anchor Repositories (TAR)



A Trust Anchor Repository (TAR) can be defined as a repository or set of repositories that may be used for storing Secure Entry Point (SEP) aka zone keys for one or more DNS zones

- Interim approach to implementing DNSSEC
 - Compensates for no signed root or TLDs
- Provides secure locations to obtain DNSSEC validation information, absent a signed root zone
- Proposed types of TARs:
 - Global TARs
 - Community of Interest (CoI) TARs
 - Local TARs

Summary

- Root must be signed!
- 6-7 ccTLDs already signed
- .ORG has announced plans to sign in 1H 2009
- Trust Anchor Repositories allow “look-aside” mechanism for DNSSEC keys
- Evangelize the need for DNSSEC at industry – companies – organizations
- Policies must be established
- What to read:
 - Introductions: www.dnssec.net
 - Tutorials: <http://www.ripe-ncc.org/training/dnssec/material/>
 - Other material:
 - <http://www.nlnetlabs.nl/dnssec/>
 - <http://www.ripe.net/disi/>

The Road Ahead



Make the DNS immune to DNS Identity Theft

- **Implement DNSSEC at the root and TLD zones**
 - Immunization against DNS hijacking
- **Proven “Chain of Trust” model protection**
 - Public key cryptography with strong encryption will protect DNS system
- **Secure storage of keys in Trust Anchor Repository**
 - Results in guaranteed lookups in a safe environment
- **Build a strong foundation for domain name owners**
 - Allows domain name owners to digitally sign their domains -- protects their names from hijacking

What You Can Do

- Talk to your web site host provider or technical provider about “Signing your zone” with a DNSSEC key
 - This will automatically protect visitors to your website from being hijacked
 - It will increase the perception and reality of security for your organization
- Sign up with mailing lists to understand more about implementing DNSSEC
 - Eliminate DNS identity theft
 - Ensure safety for your clients
 - Improve your branding

Mailing Lists

- dnssec@cafax.se
 - operators and developers working on dnssec
- namedroppers@ops.ietf.org
 - DNSEXT IETF working group (DNS protocol development)
- dnsop@cafax.se
 - DNSOP IETF working group (operational DNS issues)
- techsec@ripe.net
 - RIPE Technical Security working group
- dns-wg@ripe.net
 - RIPE DNS working group

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