DNSSEC College

Arjen Zonneveld

Jelte Jansen

DHPA Techday, 21 mei 2015

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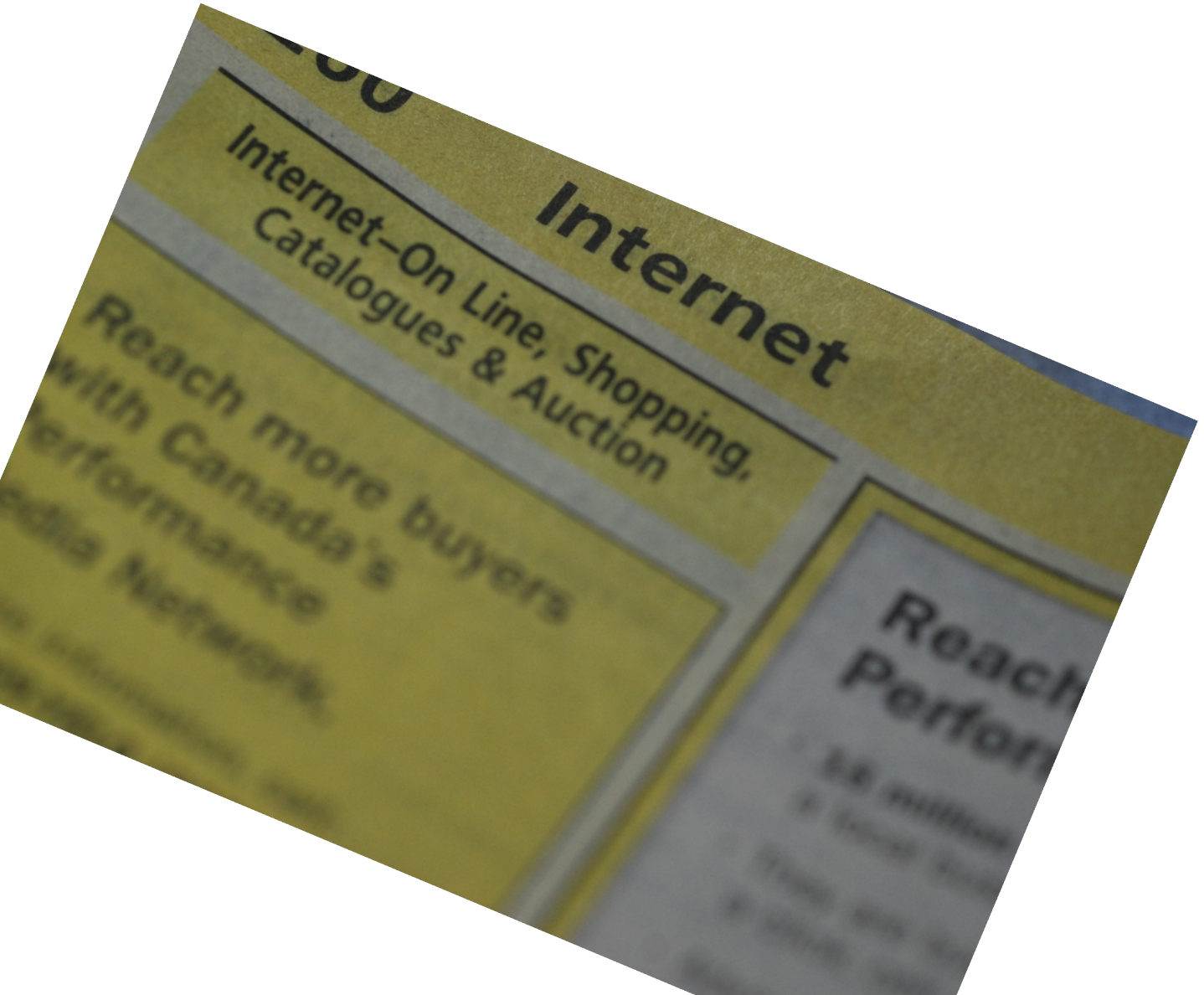

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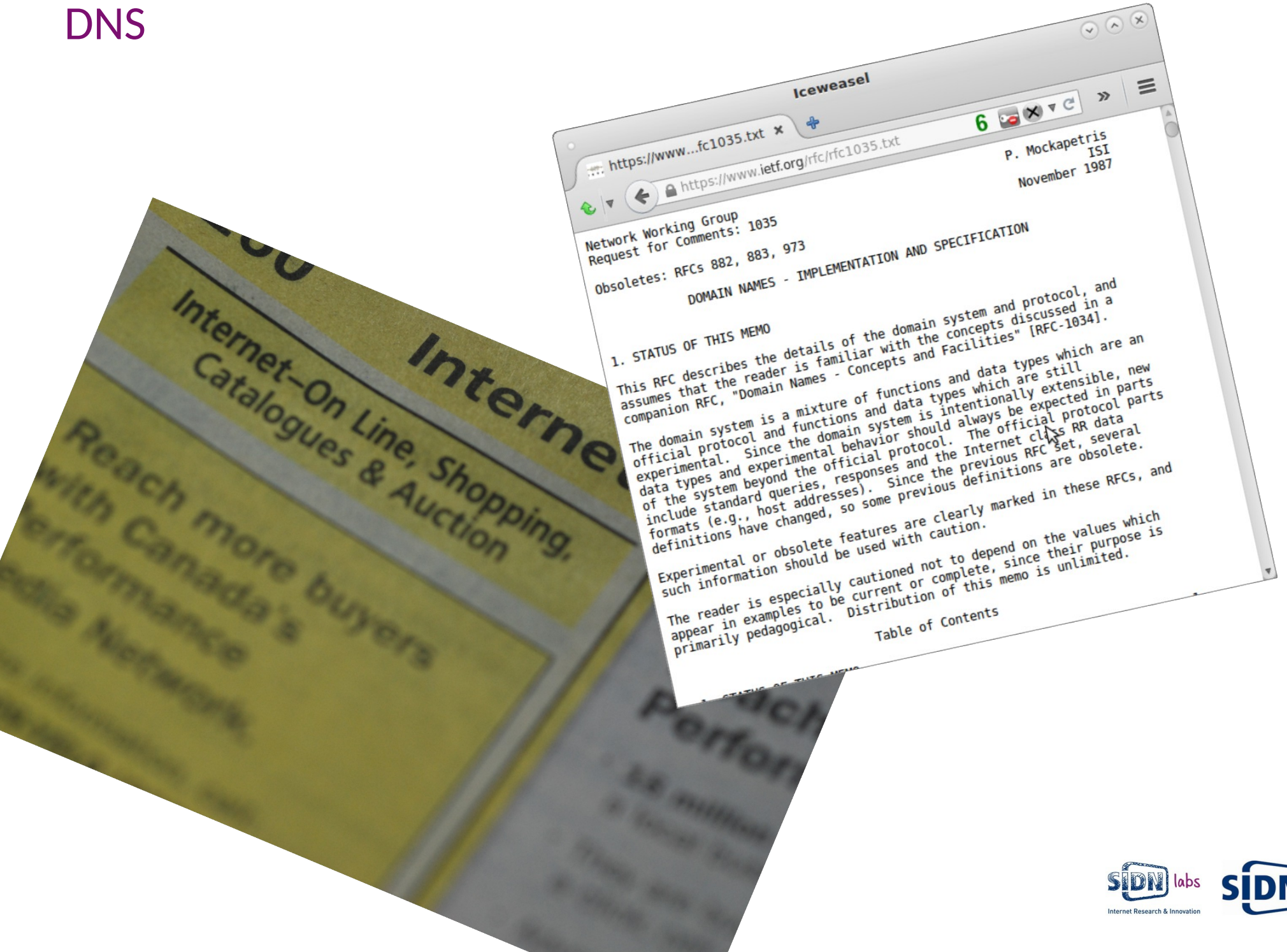

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SEEING TROUBLE
Security researcher Dan Kaminsky first spotted a basic vulnerability in the Internet last winter.

The Flaw at the Heart of the Internet

DAN KAMINSKY DISCOVERED A FUNDAMENTAL SECURITY PROBLEM IN THE INTERNET AND GOT PEOPLE TO CARE IN TIME TO FIX IT. IT'S A DRAMATIC STORY WITH A HAPPY ENDING ... BUT WE WERE LUCKY THIS TIME.

By ERICA NAONE

Dan Kaminsky, uncharacteristically, was not looking for bugs earlier this year when he happened upon a flaw at the core of the Internet. The security researcher was using his knowledge of Internet infrastructure to come up with a better way to stream videos to users. Kaminsky's expertise is in the Internet's domain name system (DNS), the protocol responsible for matching websites' URLs with the numeric addresses of the servers that host them. The same content can be hosted by multiple servers with several addresses, and Kaminsky thought he had a great trick for directing users to the servers best able to handle their requests at any given moment.

Normally, DNS is reliable but not nimble. When a computer—say, a server that helps direct traffic across Comcast's network—requests the numerical address associated with a given URL, it stores the answer for a period of time known as "time to live," which can be anywhere from seconds to days. This helps to reduce the number of requests the server makes. Kaminsky's idea was to bypass the time to live, allowing the server to get a fresh answer every time it wanted to know a site's address. Consequently, traffic on Comcast's network would be sent to the optimal address at every moment, rather than to whatever address had already been stored. Kaminsky was sure that the strategy could significantly speed up content distribution.

It was only later, after talking casually about the idea with a friend, that Kaminsky realized his "trick" could completely break the security of the domain name system and, therefore, of the Internet itself. The time to live, it turns out, was at the core of DNS security; being able to bypass it allowed for a wide variety of attacks. Kaminsky wrote a little code to make sure the situation was as bad as he thought it was. "Once I saw it work, my stomach dropped," he says. "I thought, 'What the heck am I going to do about this? This affects everything.'"

Kaminsky's technique could be used to direct Web surfers to any Web page an attacker chose. The most obvious use is to send people to phishing sites (websites designed to trick people into entering banking passwords and other personal information, allowing an attacker to steal their identities) or other fake versions of Web pages. But the danger is even worse: protocols such as those used to deliver e-mail or for secure communications over the Internet ultimately rely on DNS. A creative attacker could use Kaminsky's technique to intercept sensitive e-mail, or to create forged versions of the certificates that ensure secure transactions between users and banking websites. "Every day I find another domino," Kaminsky says. "Another thing falls over if DNS is bad. ... I mean, literally, you look around and see anything that's using a network—*anything* that's using a network—and it's probably using DNS."

Kaminsky called Paul Vixie, president of the Internet Systems Consortium, a nonprofit corporation that supports several aspects of Internet infrastructure, including the software most commonly used in the domain name system. "Usually, if somebody wants to report a problem, you expect that it's going to take a fair amount of time for them to explain it—maybe a whiteboard, maybe a Word document or two," Vixie says. "In this case, it took 20 seconds for him to explain the problem, and another 20 seconds for him to answer my objections. After that, I said, 'Dan, I am speaking to you over an unsecure cell phone. Please do not ever say to anyone what you just said to me over an unsecure cell phone again.'"

Perhaps most frightening was that because the vulnerability was not located in any particular hardware or software but in the design of the DNS protocol itself, it wasn't clear how to fix it. In secret, Kaminsky and Vixie gathered together some of the top DNS experts in the world: people from the U.S. government and

Photograph by JOHN KEATLEY

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Security / Report Claims DNS Cache Poisoning Attack Against Brazilian Bank and ISP

Report Claims DNS Cache Poisoning Attack Against Brazilian Bank and ISP

By Larry Seltzer | Posted 2009-04-22 Email Print

OPINION: Attack shows the potential for serious spoofing attacks that could leave end users helpless. The only real solution is DNSSEC, which will take years to implement under the best of circumstances.

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FEATURE STORY 63

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DNS cache poisoning attac exploited in the wild

Summary: *UPDATE: Arbor Networks have provided more details in thei Attack Activity" analysis, SANS confirmed HD Moore's statement on DNS c DNS servers. Numerous independent sources are starting to see evidence o attempts on their local networks, in what appears to be an attempt to take "recent" DNS cache poisoning vulnerability :" client 143.*

By Dancho Danchev for Zero Day | July 29, 2008 -- 03:24 GMT (04:

Get the ZDNet Security newsletter now

UPDATE: Arbor Networks have provided more details in their "30 Days of DNS analysis, SANS confirmed HD Moore's statement on DNS cache poisoned AT&T independent sources are starting to see evidence of DNS cache poisoning atten networks, in what appears to be an attempt to take advantage of the "recent"

The DNS server at is NOT overtly vulnerable, however, it may be subtly vulnerable* i POOR or FAIR.

Test	Rating	Notes	Scatterplot

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DNS poisoning slams web traffic from millions in China into the wrong hole

ISP blames unspecified attack for morning outage

By John Leyden, 21 Jan 2014

8

A widespread DNS outage hit China on Tuesday, leaving millions of surfers adrift.

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HOME « NEWS « TOP SECURITY STORIES « GOOGLE'S MALAYSIAN DOMAINS HIT WITH DNS CACHE POISONING...

GOOGLE'S MALAYSIAN DOMAINS HIT WITH DNS CACHE POISONING ATTACK

PREVIOUS CONTRIBUTORS

OCT 11, 2013

Google's Malaysian domains google.com.my and google.my were hijacked, redirecting users to a webpage that announced the attack was perpetrated by a Pakistani group called Madleets. MYNIC, the sole administrator for web addresses in Malaysia confirmed the attack in a statement.

"We can confirm there was unauthorised redirection of www.google.com.my and www.google.my to another IP address by a group which called themselves TeaM MADLEETS," the MYNIC statement says.

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nillions

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DN in ISP

By Jo

DNSSEC in vogelvlucht: Signeren

DNSSEC in vogelvlucht: Signeren

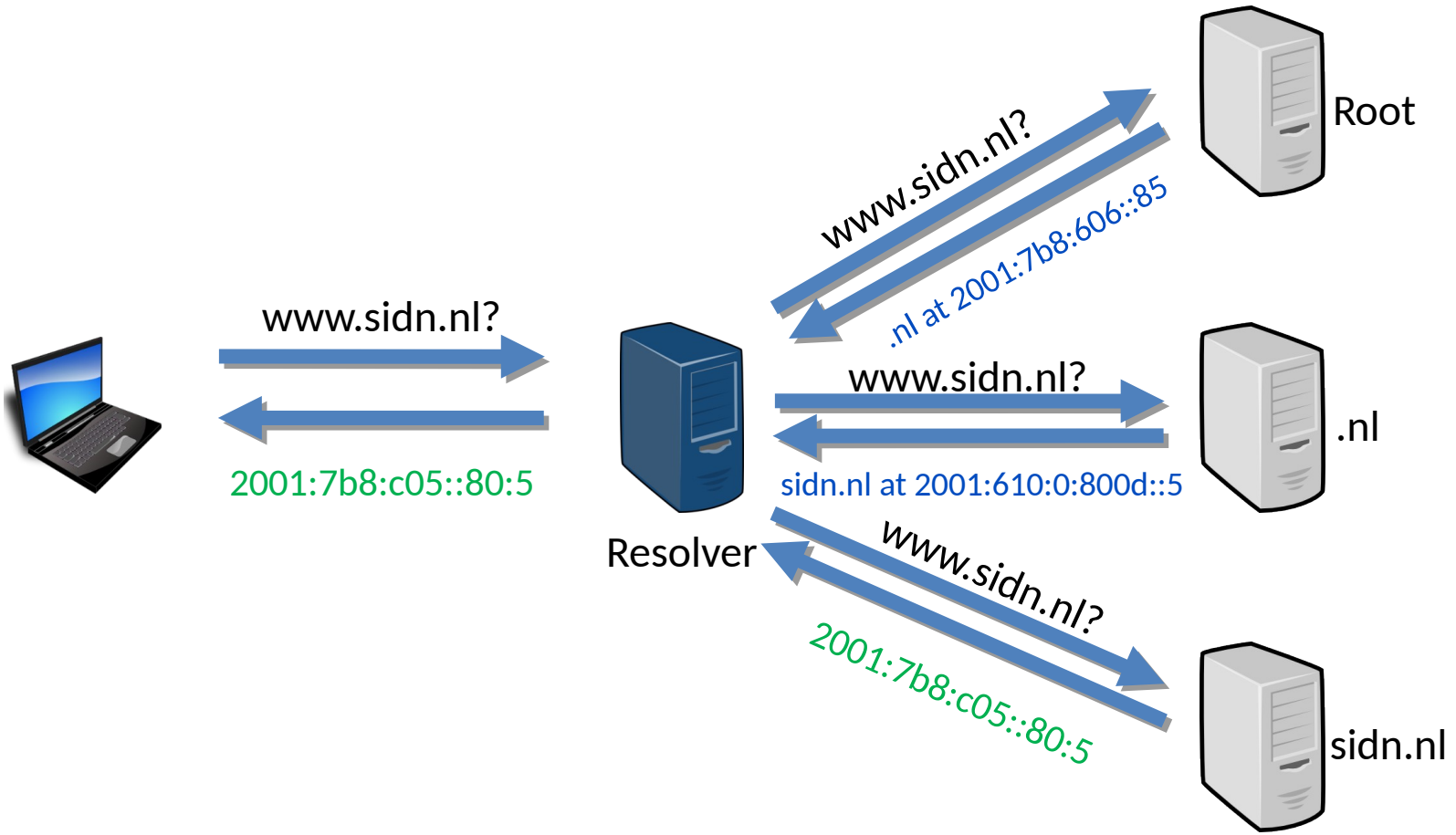
RRSIG

```
example.dom. 7200  RRSIG   SOA 5 3 7200
20131113113016 (
        20131014113016 57798 example.dom.
        TWLzBuUgXWMA9cj+xe6YMjXy2/VdauWnONk7
        uAP8JcdzsemcfWov4cFzXowS2YX291+5jBMp
        m5AlwpM7ijbSBgAGz22ywlKN8JoOg3KtCM2Y
        UX/c8/ATbYEBPKRjBs+YQKmY1NppwSjFi9Y0
        1fVEBbrCnI0EP33c/VK97s8oNG8= )
```

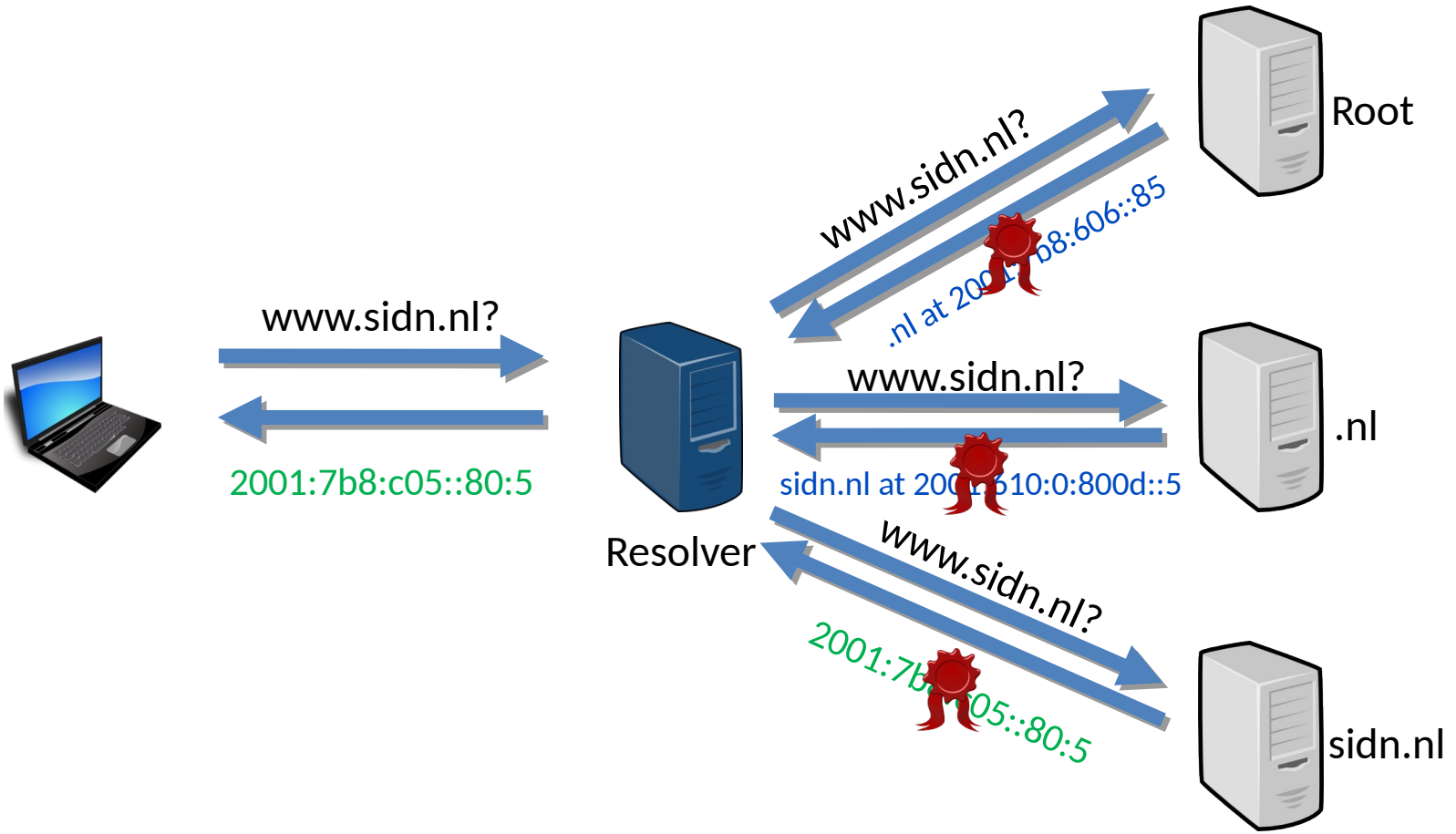
DNSSEC in vogelvlucht: signen

- Maak een keypair aan
- Sign je zone(s)
  - BIND, NSD+ldns, PowerDNS, Secure64, Infoblox, etc.
- Publiceer gesignde zones
- Stuur public key naar parent

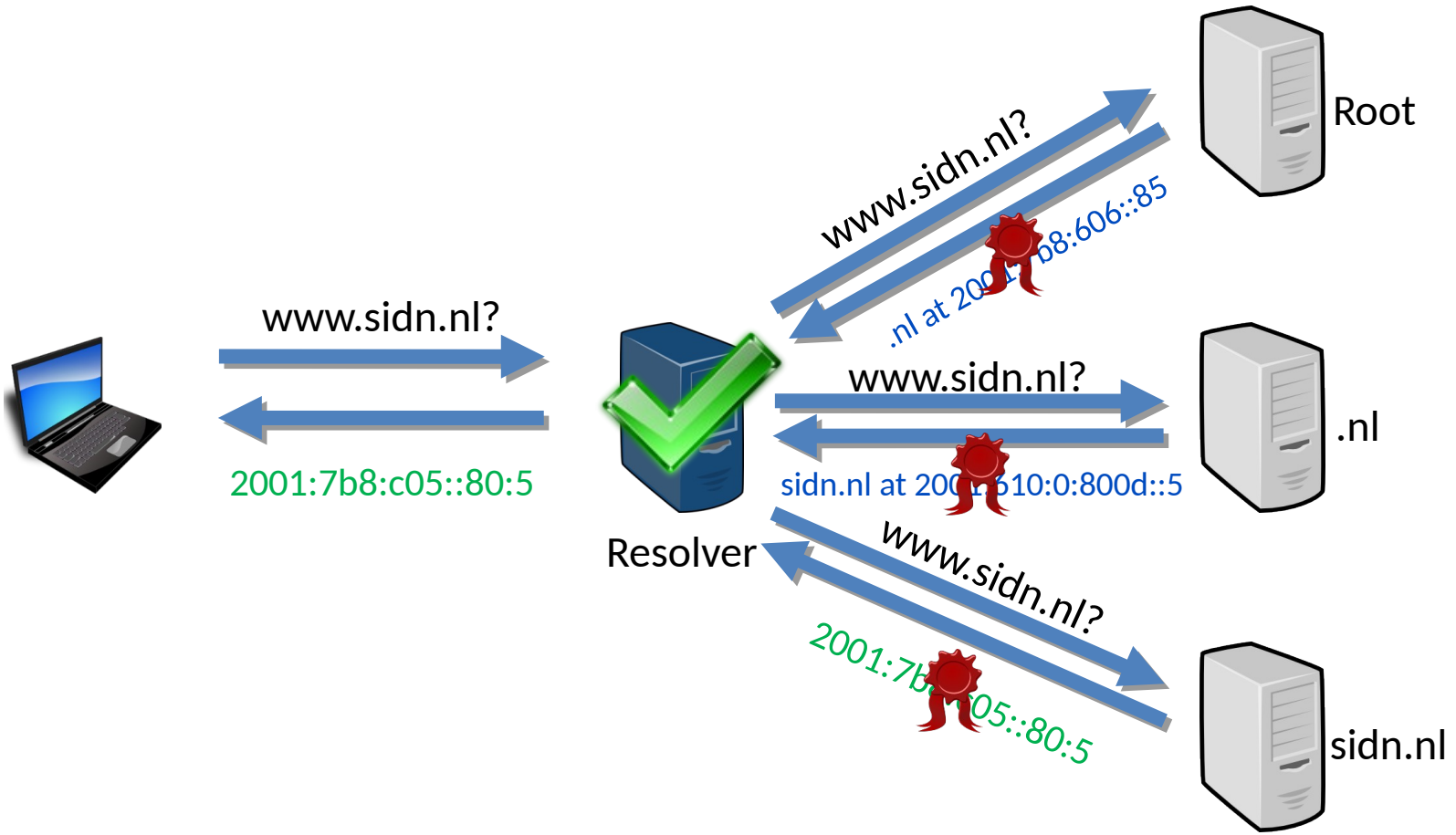
DNSSEC in vogelvlucht



DNSSEC in vogelvlucht

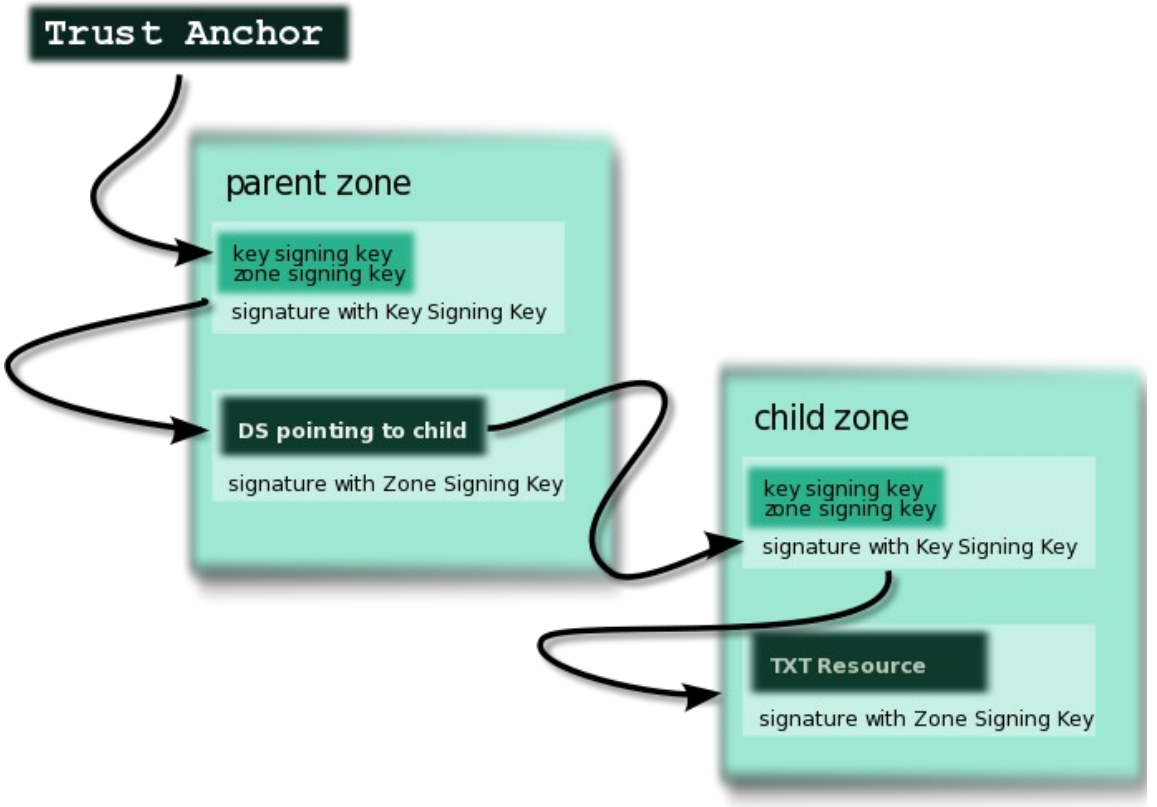


DNSSEC in vogelvlucht

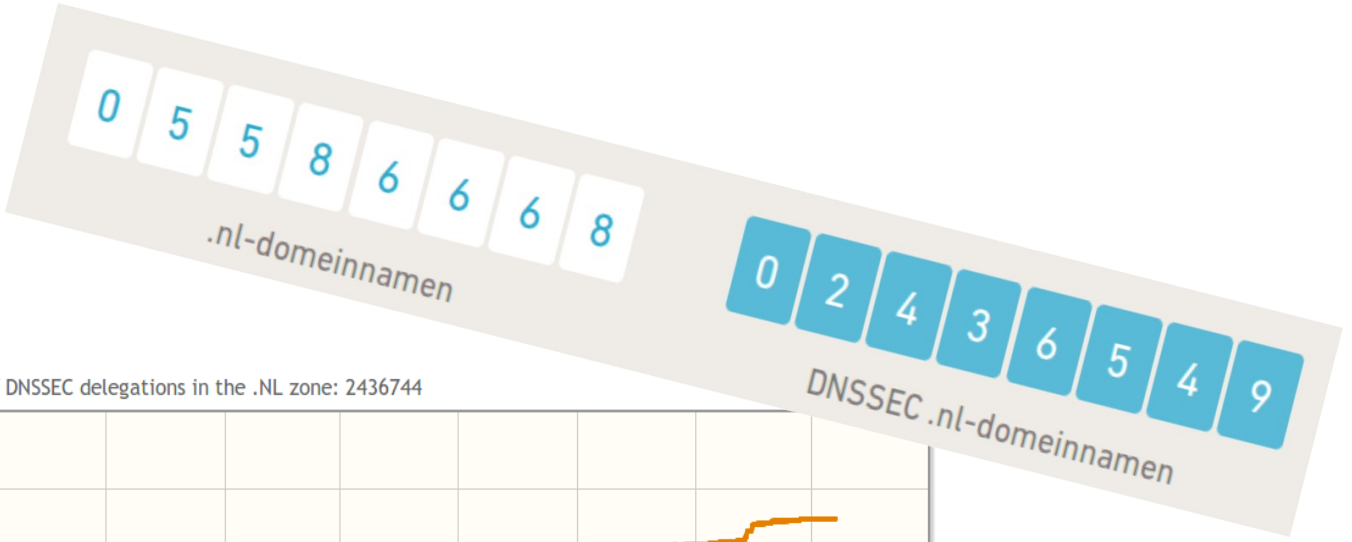


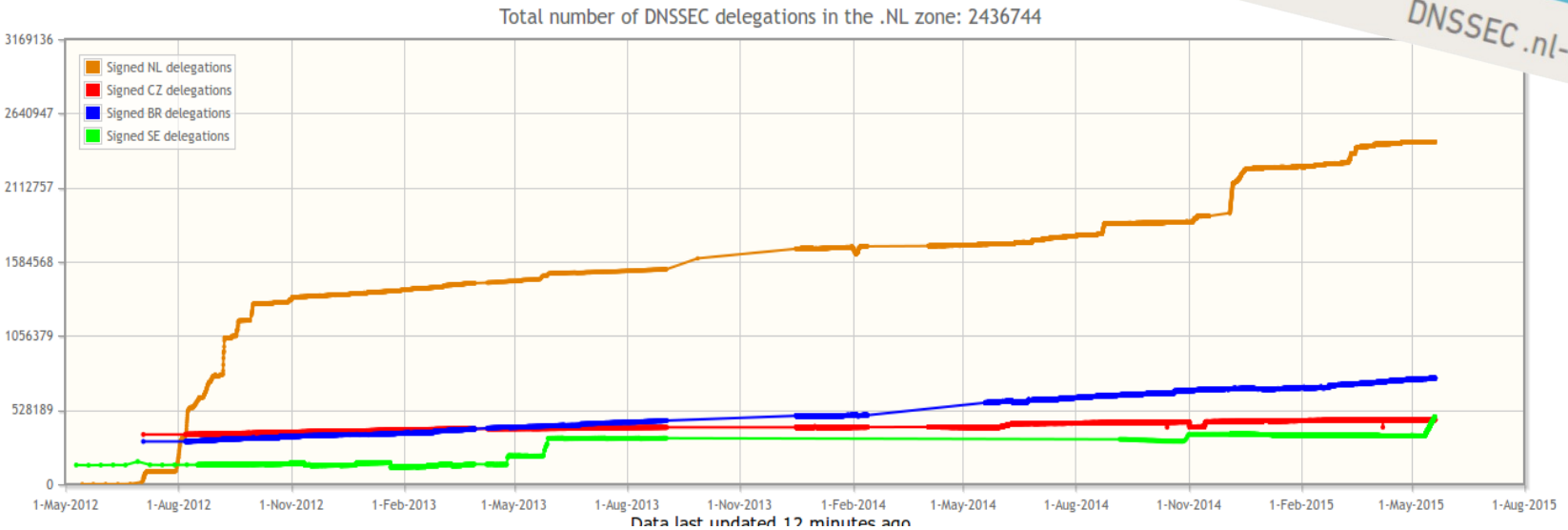
DNSSEC in vogelvlucht: chain of trust

- Chain of trust:
  - Vanaf een Trust Anchor (de root)
  - Via delegaties (.nl, sidn.nl)
  - Naar het antwoord (www.sidn.nl)



DNSSEC in .nl: zones





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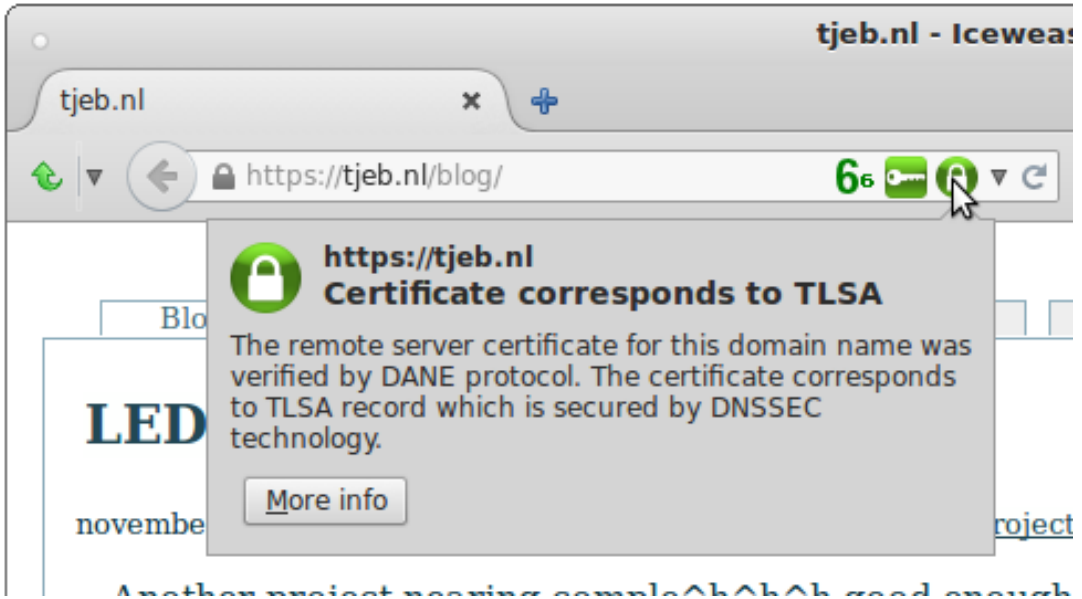
DNSSEC als basis

- DANE: verbindt X.509 (bekend van https) met DNS(SEC)
  - Aanvullend op CA
  - Maakt werkende self-signed certificates mogelijk

- In browser (met plugin; geen native support)

- Mail Transfer Agents
  - native support in Postfix (2.11)
  - Experimental support in Exim (4.85)



DANE voor SMTP

- Nu vaak opportunistic encryption
  - Want geen interactie met gebruiker
  - Biedt weinig bescherming boven geen encryption

- Met DANE geef je certificaatkenmerken aan via DNSSEC
  - Verzender weet dat er encryption gebruikt kan worden
  - Niet meer opportunistic

- DNS Record:
  - `_25._tcp.<mailserver>.  3600 TLSA  3 0 1 <fingerprint of cert>`

DANE voor SMTP

Zonder DNSSEC/TLSA:

```
Mar 16 19:11:03 m3 postfix/smtp[25929]:
Untrusted TLS connection established to
mail1.example.de[2001:db8:100::25]:25:
TLSv1 with cipher ECDHE-RSA-AES256-SHA
(256/256 bits)
```

Met DNSSEC/TLSA:

```
Mar 16 19:20:01 m3 postfix/smtp[26131]:
Verified TLS connection established to
mail.example.de[2001:db8:100::25]:25:
TLSv1 with cipher ECDHE-RSA-AES256-SHA
(256/256 bits)
```

SSHFP

DNS:

```
<hostname> 3600  IN  SSHFP  1 1 9CF43AD8D319F3854F84B841594101A82EF8227C
```

SSH client config:

```
VerifyHostKeyDNS yes
```

SSHFP

Zonder SSHFP:

```
debug1: Server host key: RSA
a1:72:a5:45:ac:f7:8e:a5:c7:50:e8:aa:b5:d9:7f:30
The authenticity of host 'tjeb.nl (2a02:348:55:5250::80)'
can't be established.
Are you sure you want to continue connecting (yes/no)?
```

Met SSHFP:

```
debug1: Server host key: RSA
a1:72:a5:45:ac:f7:8e:a5:c7:50:e8:aa:b5:d9:7f:30
debug1: found 1 secure fingerprints in DNS
debug1: matching host key fingerprint found in DNS
debug1: ssh_rsa_verify: signature correct
```

Signing methodes

- Offline signing
  - BIND
  - OpenDNSSEC
  - ldns
- Online signing
  - BIND
  - Powerdns
  - Knot
- Automatic key rolling
  - BIND
  - OpenDNSSEC
- Plesk plugin 'Admin-ahead DNSSEC'

PowerDNS voorbeeld

Sign zone:

```
pdnssec secure-zone powerdnssec.org
pdnssec rectify-zone powerdnssec.org
```

Vraag DNSKEY (of DS) om naar parent te sturen:

```
pdnssec show-zone powerdnssec.org
```

BIND voorbeeld

Live demo

Valkuilen

- Verhuizingen
- Minder vergevingsgezind dan DNS
  - Alle delegaties moeten expliciet zijn
  - Let op met wildcards en empty-nonterminals
- Wel DS, geen DNSKEY
- Verlopen RRSIGs
- Antwoorden worden groter
  - Gebruik RRL if supported
- Controleer!

Monitoring / Debugging

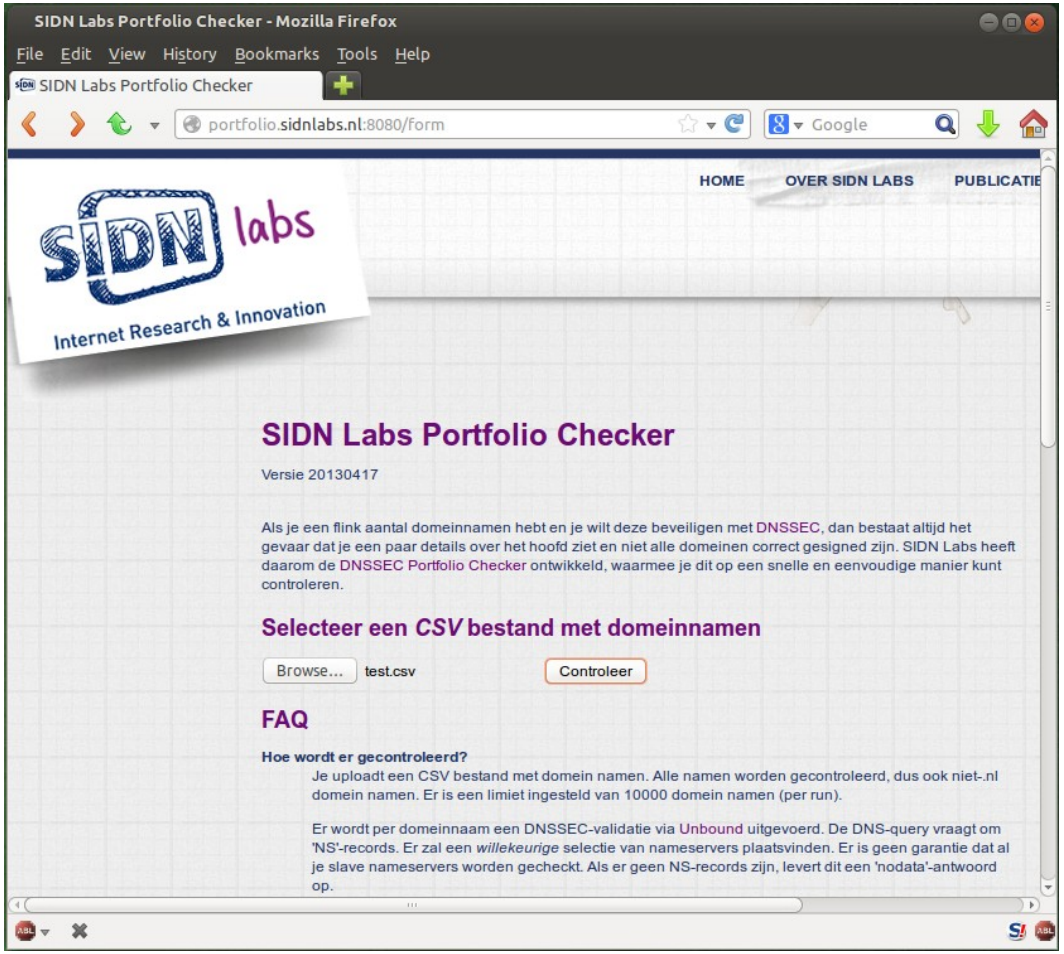
- Plugins
  - Nagios
  - Zabbix

- Online tools
  - DNSViz
  - SIDN DNSSEC portfolio checker
  - DNSCheck
  - internet.nl

- CLI debugging
  - dig (BIND)
  - drill (ldns)
  - logging

DNSSEC Test sites

- Signeren:
  - http://portfolio.sidnlabs.nl:8080/form



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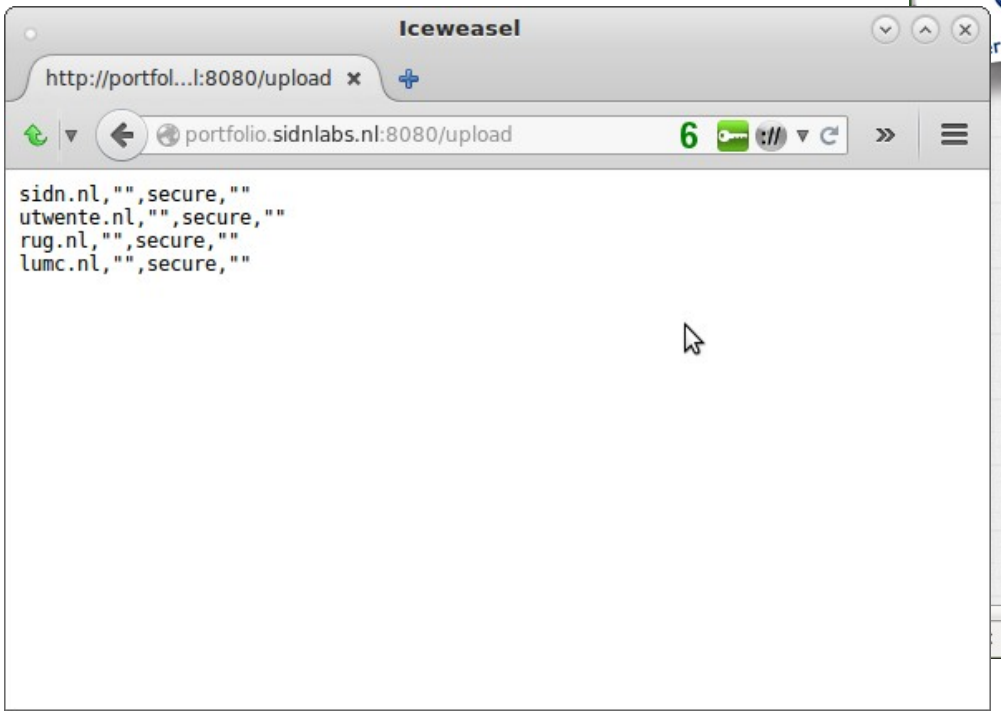
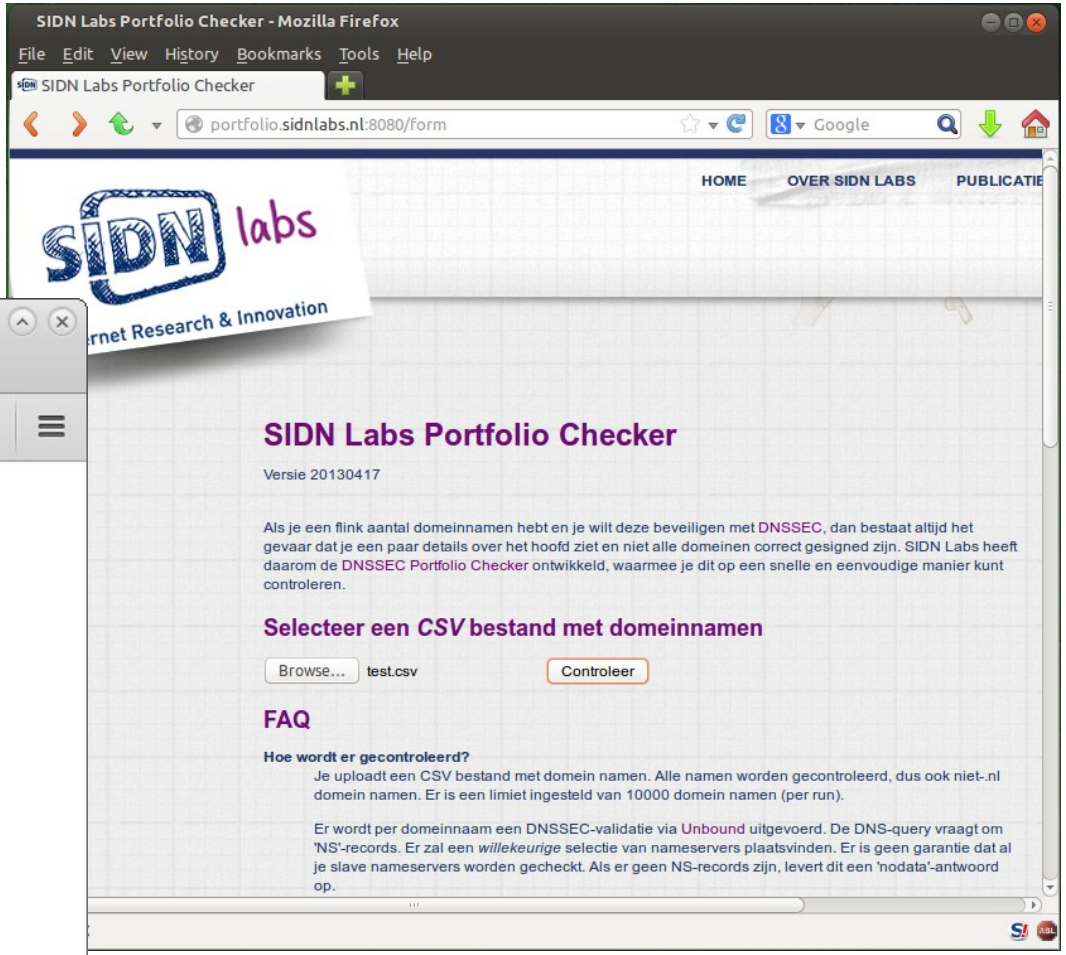
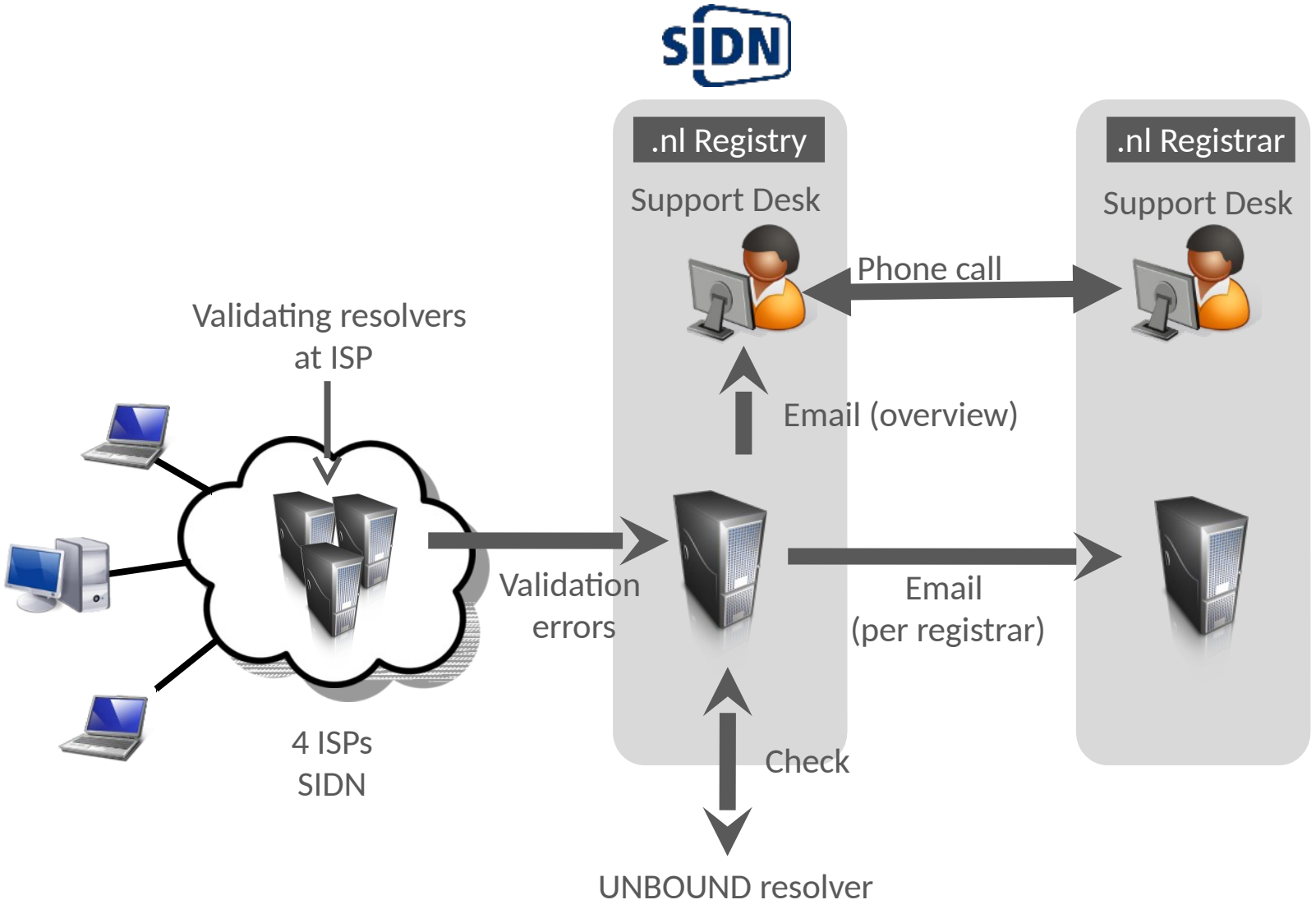




DNSSEC validatie monitor



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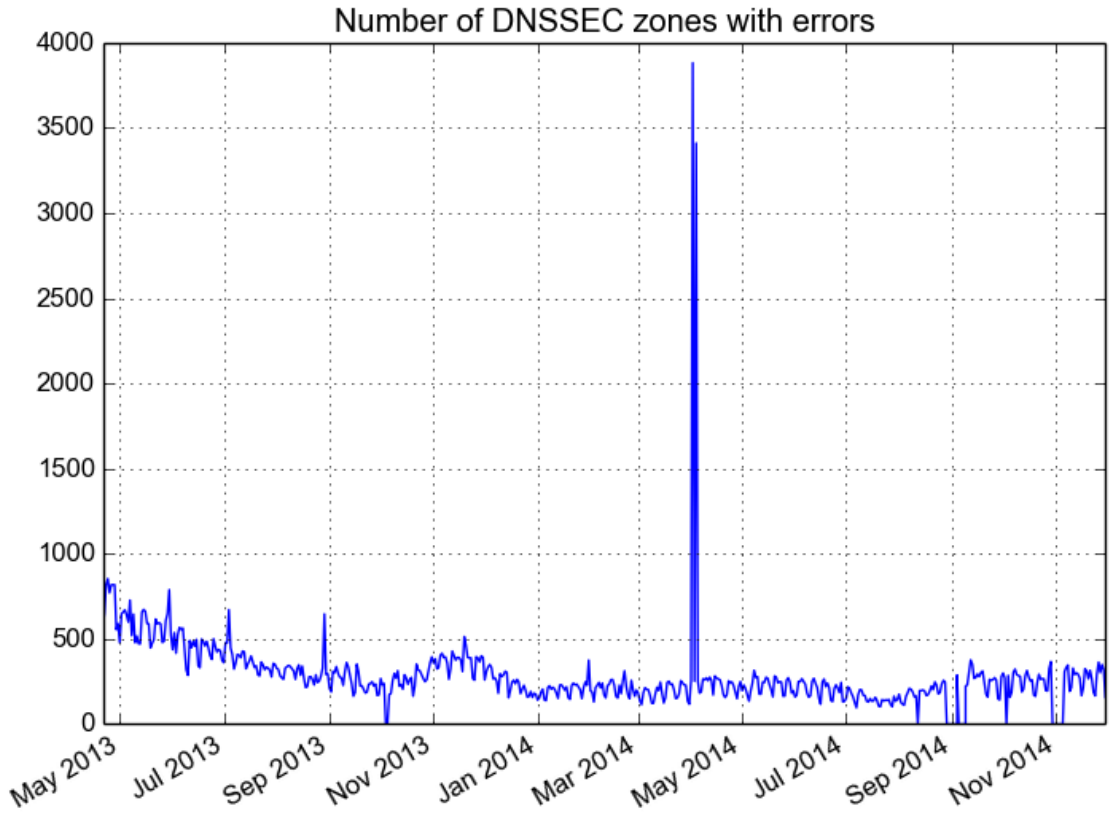
Validatie errors



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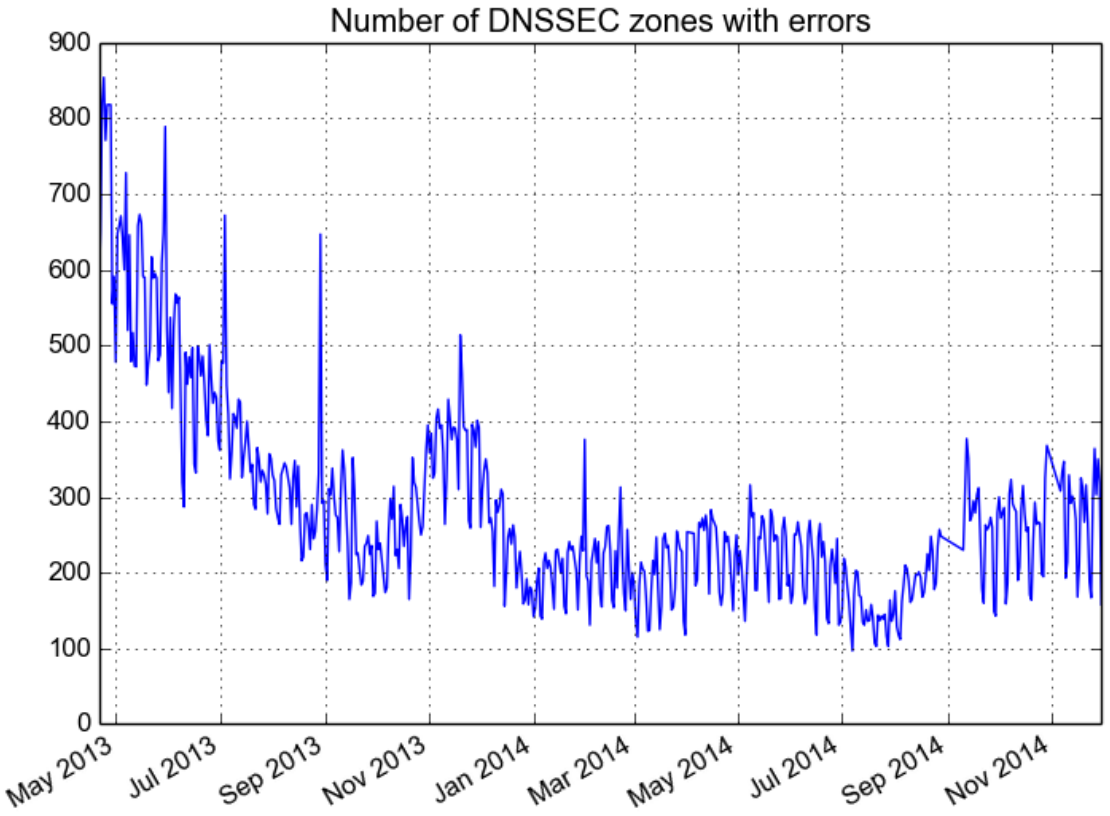

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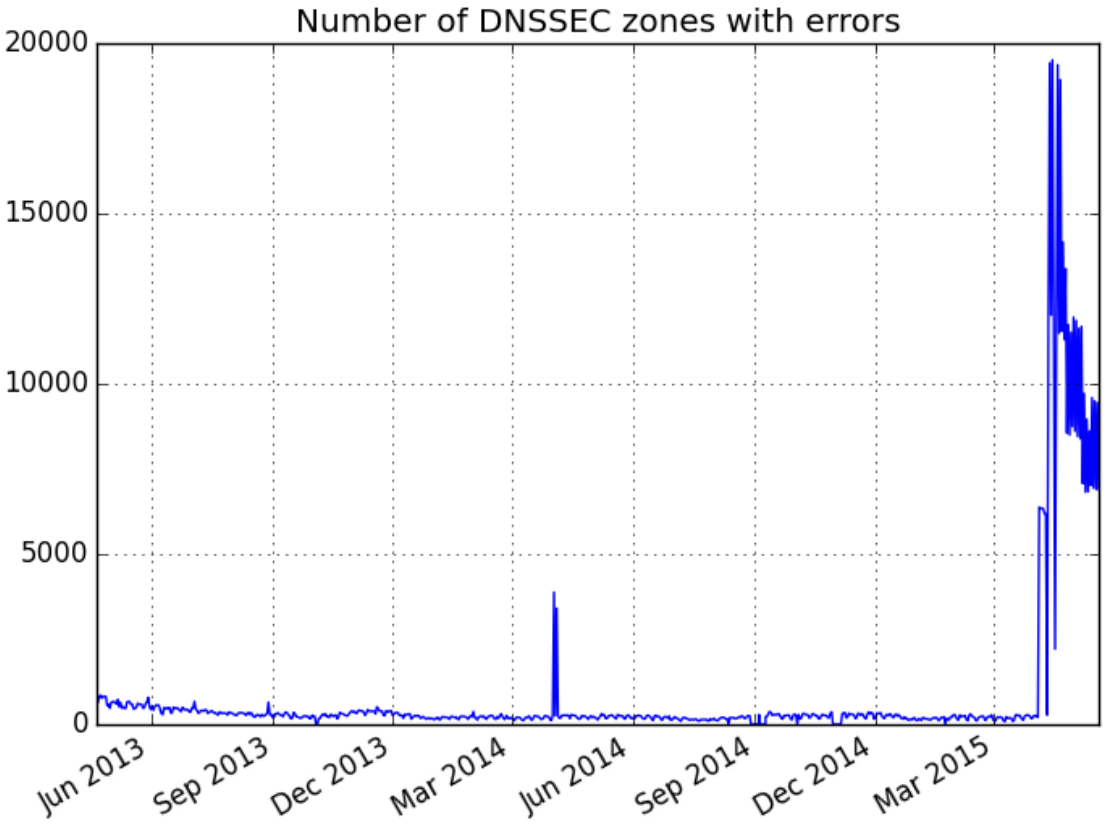

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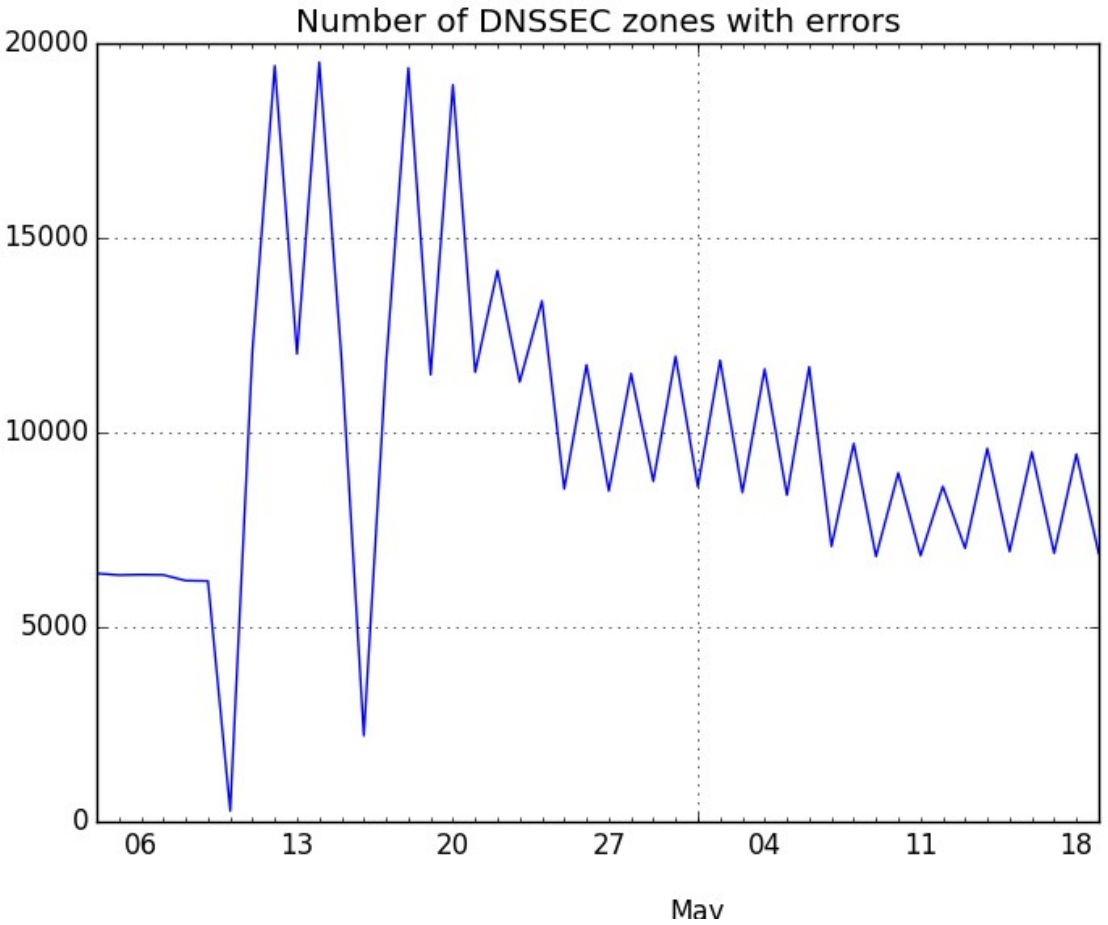
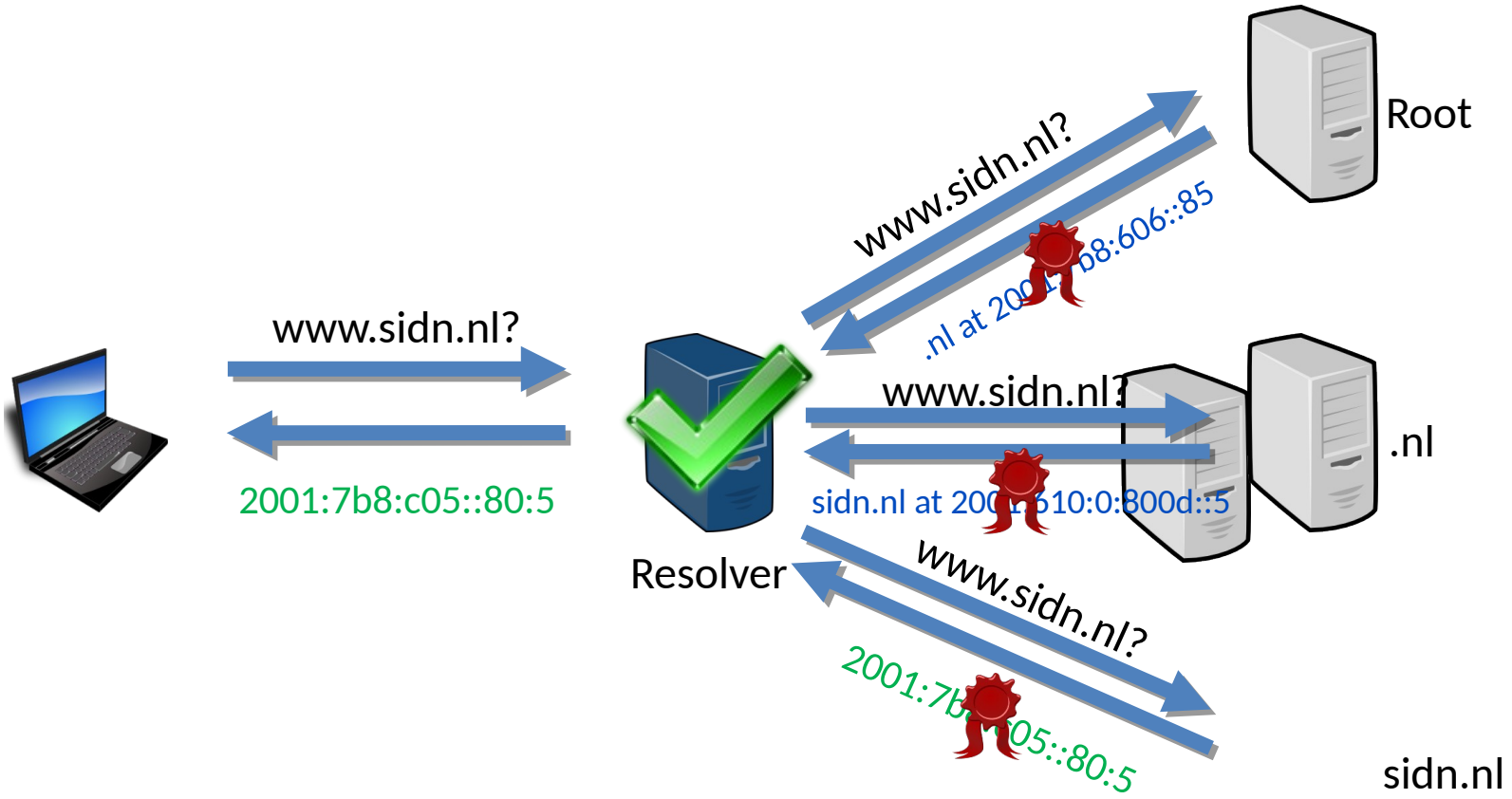


DNSSEC in vogelvlucht



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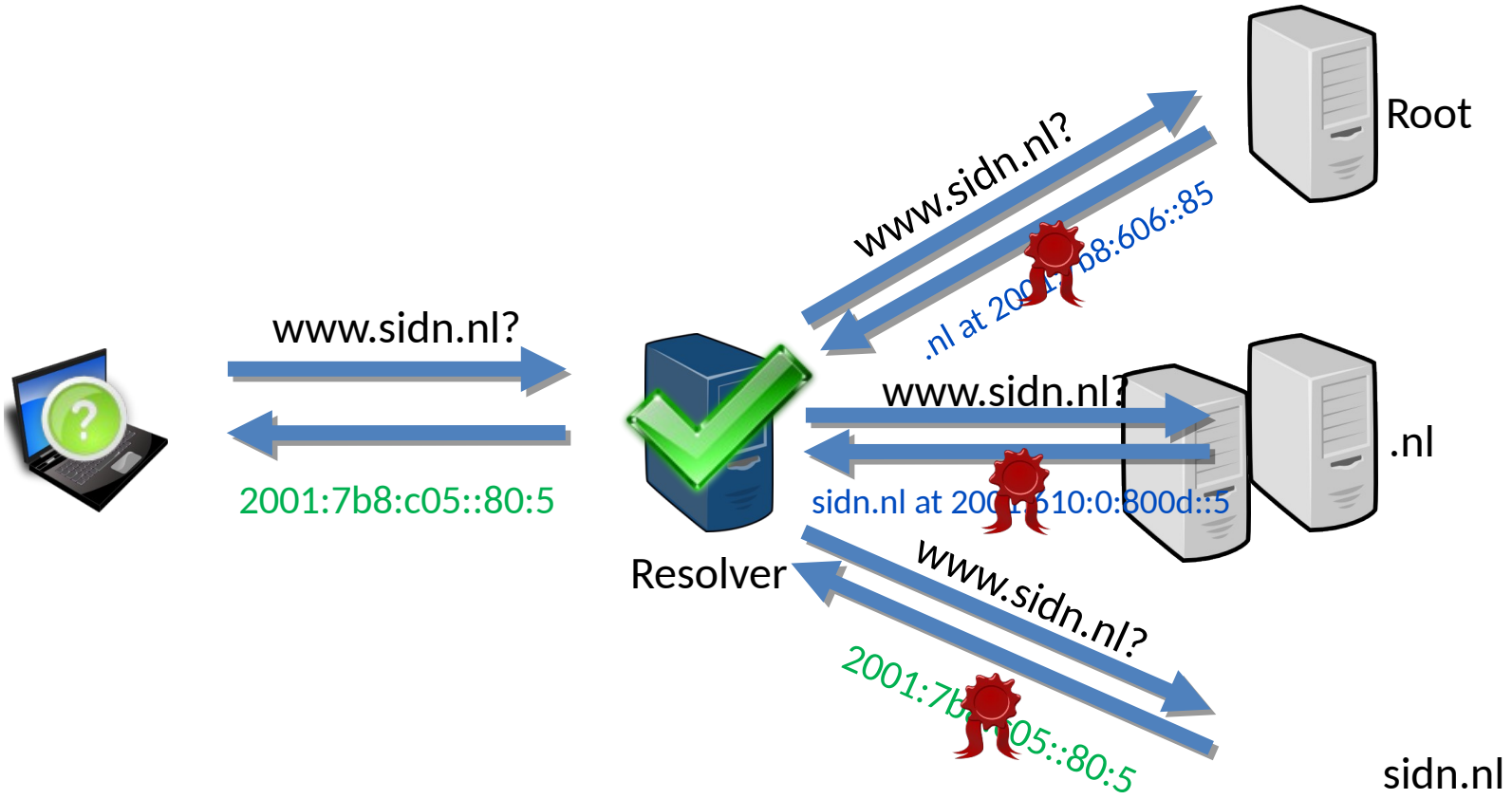

DNSSEC Test sites

- Validatie:
  - https://dnssectest.sidnlabs.nl

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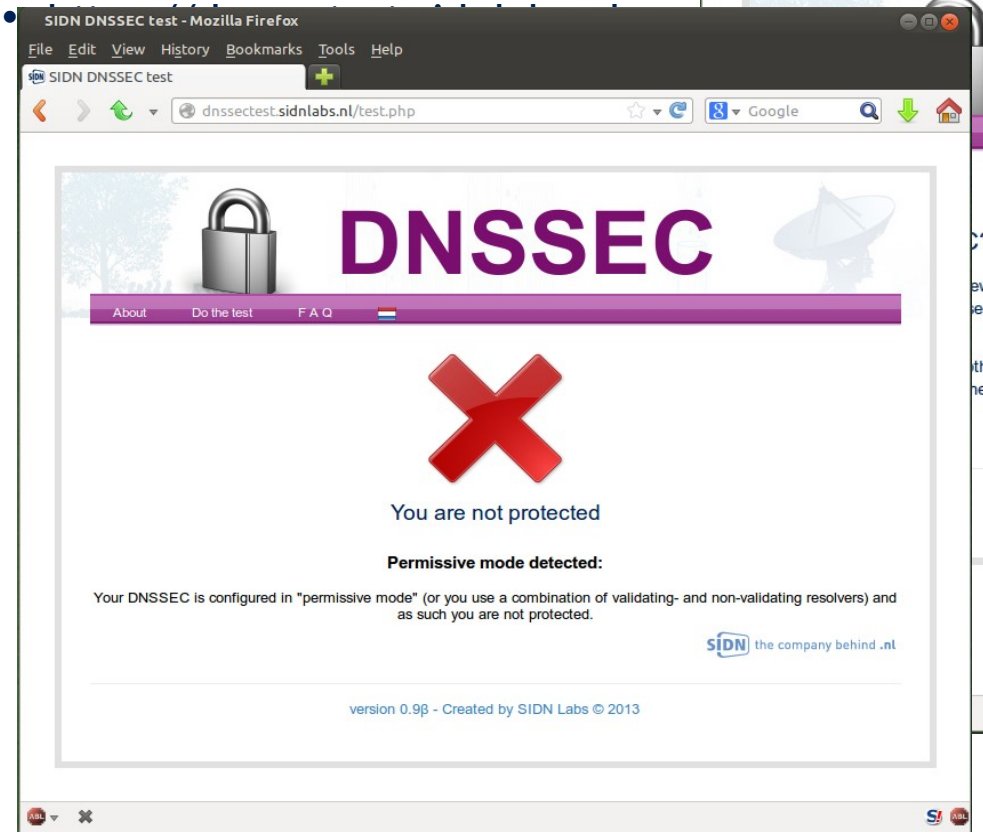
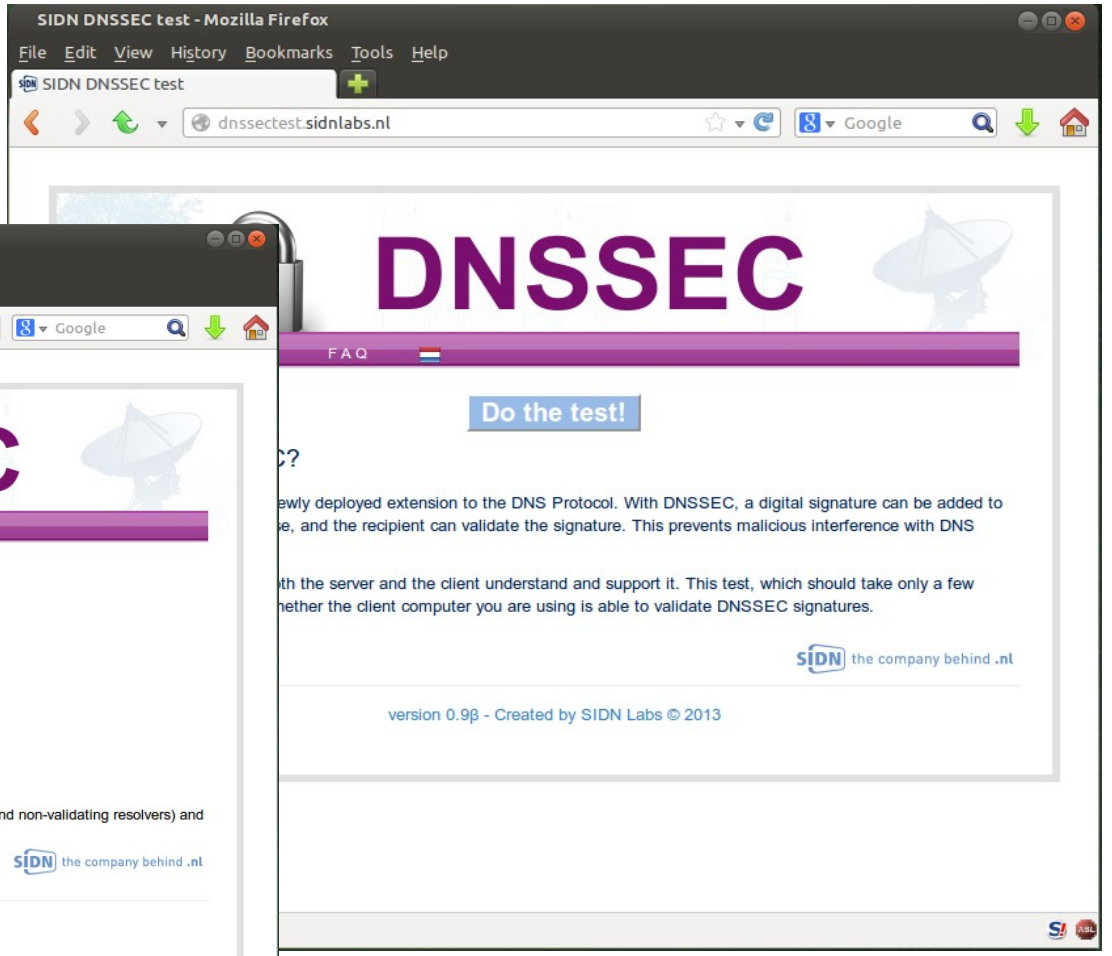
DNSSEC Test sites

- Validatie:
  -





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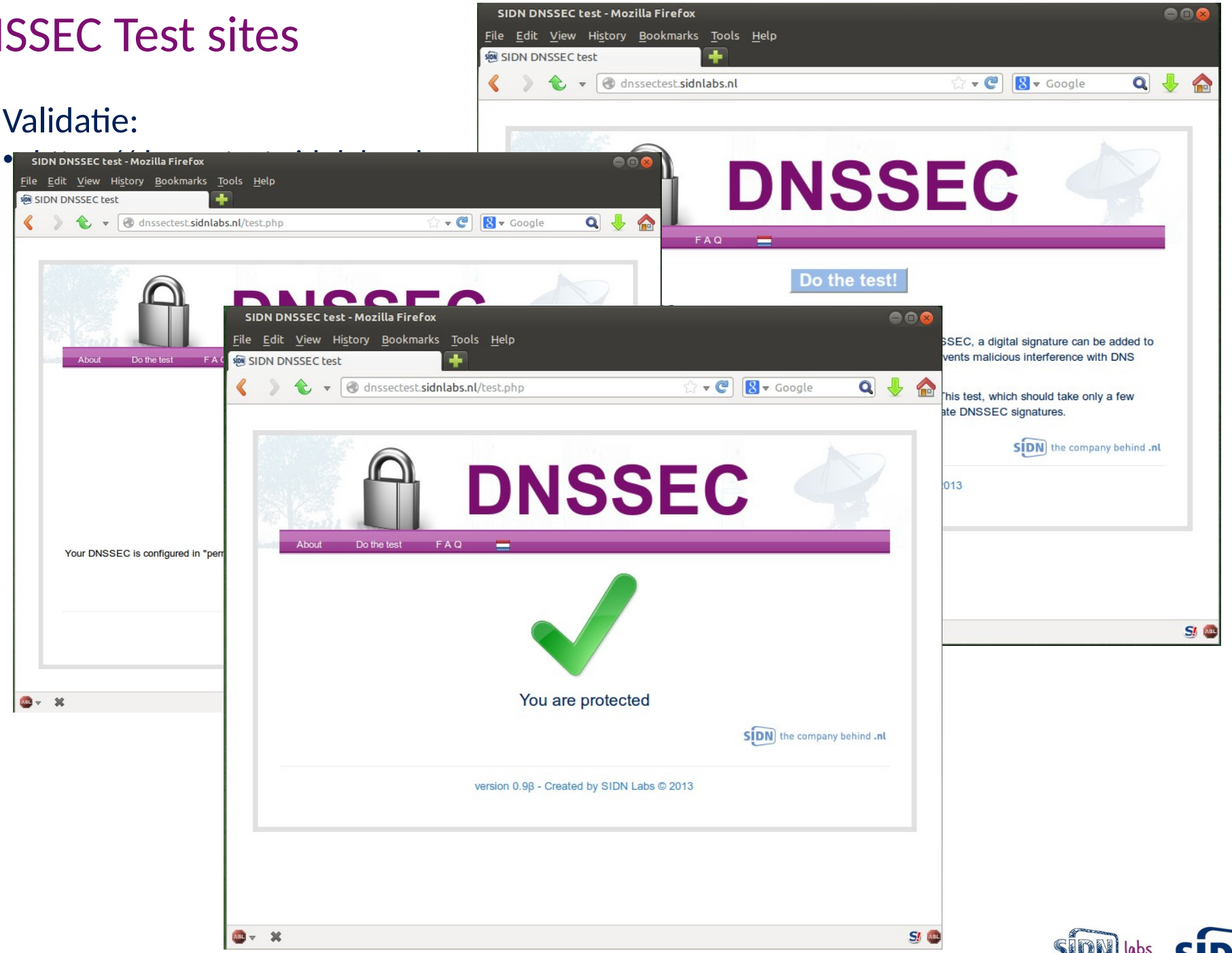
  -



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DNSSEC Informatiesites

- http://www.dnssec.nl
- http://www.dnsseccursus.nl

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Prijsvraag!

Beantwoord de vraag:

“Hoe denk jij dat de internetsector het gebruik van DNSSEC(-validatie) zou kunnen versnellen?

en maak kans op een GL-iNet device!

DNSSEC Informatiesites

- http://www.dnssec.nl
- http://www.dnsseccursus.nl

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