IEncrypt – a work-in-progress

open-source initiative to increase encryption of traffic to and from .ie web sites, starting with newly registered second-level .ie domains.

Developed by Tolerant Networks Limited
Funded by IEDR
Considered important by both:-)

October 2015, ICANN54, Dublin, Ireland

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.ie
Identifiably Irish
Ireland's Domain Registry

Aside...

- I'm doing this presentation on behalf of IEDR as I did the dev work:-)
- I'm not doing this as IETF security area director nor for Trinity College Dublin

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- Initial Goals
- Benefits of Success
- Technical Approach
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- Conclusion
- <Boring Extra Details as Backup>
- <Demo as we go, or later, or earlier>

Problem

- 20 years on, only about 30% of web sites talk https
  - Precise figure not the point but the trajectory in particular for smaller web sites
- Cleartext => larger attack surface
  - For example: Firesheep, great-cannon
  - More attacks => more support/cost/trouble
- Getting certificates for domains and web-sites is too hard for an average registrant or site admin, or they don't care (enough)
  - or they don't even think of it

Initial Goals

- “IEncrypt” check-box for registrants as they create a new .ie domain with associated web server hosting
  - We're providing proof-of-concept for what's behind that checkbox and happy to talk about providing more
- From the very first DNS query and the very first HTTP response, the hosted site will benefit from state of the art security protocols:
  - DNSSEC validating, chaining up to .ie and .
  - Web site gets an “A” from e.g. ssllabs site tester
  - WebPKI leveraging DNSSEC (at issuance time) using Letsencrypt.org
- Aim is medium level security, **reliability and simplicity are more important goals**
  - Opportunistic security design pattern (RFC7435) says that's a valid approach

Benefits of Success

- Site visitors less likely to be hacked via bogus access point attacks (simple cookie theft)
- Site can make better use of “powerful features” that may no longer be available in browser via cleartext
- Fewer browser warnings (e.g. mixed content) to annoy visitors
- Fewer support calls to registrar as sites consider whether/how to setup TLS and as they (try) do that
  - note: that's a guess, feedback /facts welcome
- Common good – helping realise a better Internet [RFC7258]
- SEO ranking - https scores better!
  - http://googlewebmastercentral.blogspot.ie/2014/08/https-as-ranking-signal.html

Technical Approach

- Registrant wants a new .ie domain and web-site hosting (e.g. apache via VIP), with all being provided by Registrar
- Either by default or via a checkbox, the “IEncrypt” option is selected
  - An “IEncrypt advanced” could allow client key gen and other options via CLI, with step-by-step guidance (later)
- Registrar uses DNSSEC and letsencrypt.org (LE) CA to get apache running on port 443 from the very start with no browser warnings and no registrant effort
  - Registrar → Registry gets DNSSEC setup
  - Registrar → LE web server certs setup based on DNSSEC signed zone

DNSSEC Setup

- Registrar generates ZSK and KSK and submits DS to registry
  - Extend existing API hosted by Registry
  - Registry signs zone including DS
- Registrar populates zone with DNSSEC RRs
- DNSSEC rollover automation is very important
  - But actually much less so in this case!
  - A DNSSEC rollover-fail will not affect the web site (today)

Web Server Cert Setup

- Registrar generates web server key pair (and initial content)
- Registrar sets up authorization for new domain with LE and is issued with a DNS-challenge
- Registrar includes response to DNS-challenge in signed zonefile for new domain
- Registrar instantiates VM image in hosting
- Registrar runs apache or nginx install with bettercrypto.org recommended settings and key pair
- Web site gets an “A” from ssllabs.com site tester from start

Reliability

- Critical goal: don't make things worse
- Need key rolling for DNSSEC to work seamlessly with no registrar effort
  - dnssec-tools 'rollerd' does this
  - New RFCs coming on automating DS rollover
- Web server cert update will be seamless
  - letsencrypt.org client does this
  - Can be independent of DNSSEC after 1st keys done

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Plan

1) **IEDR and TN demo a Proof-of-Concept (PoC)**
2) Discuss details with Registrars/Hosters
3) Implement DNSSEC authorization with LE
4) Incorporate registrar/LE feedback into code
5) Implement and deploy in registry
6) Registrars who want to play can test
7) All code/tooling will be open-source, BSD license

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PoC Status

- https://testbed.ie proof-of-concept
  - Plays the role of the ccTLD in the PoC
  - testbed.ie pretends to be .ie
- PoC allows one to create a new child domain that is DNSSEC signed and with web server cert issued by LE
  - Working now, runs asynchronously (~5min cycle)
  - Screen-shots + details in backup slides
- Implementation available, all BSD license
  - https://basil.dsg.cs.tcd.ie/code/tcd/iencrypt
    - Mercurial repo, bogus TLS cert:-)
  - May move to github, soon's I get a chance
    - If so, look below https://github.com/sftcd/

PoC Hosts

https://testbed.ie
https://<foo>.testbed.ie
(hoba.ie)

request staging
web server virtual hosts
web server config & keygen (webcfg)
LE client (after DNSSEC done)

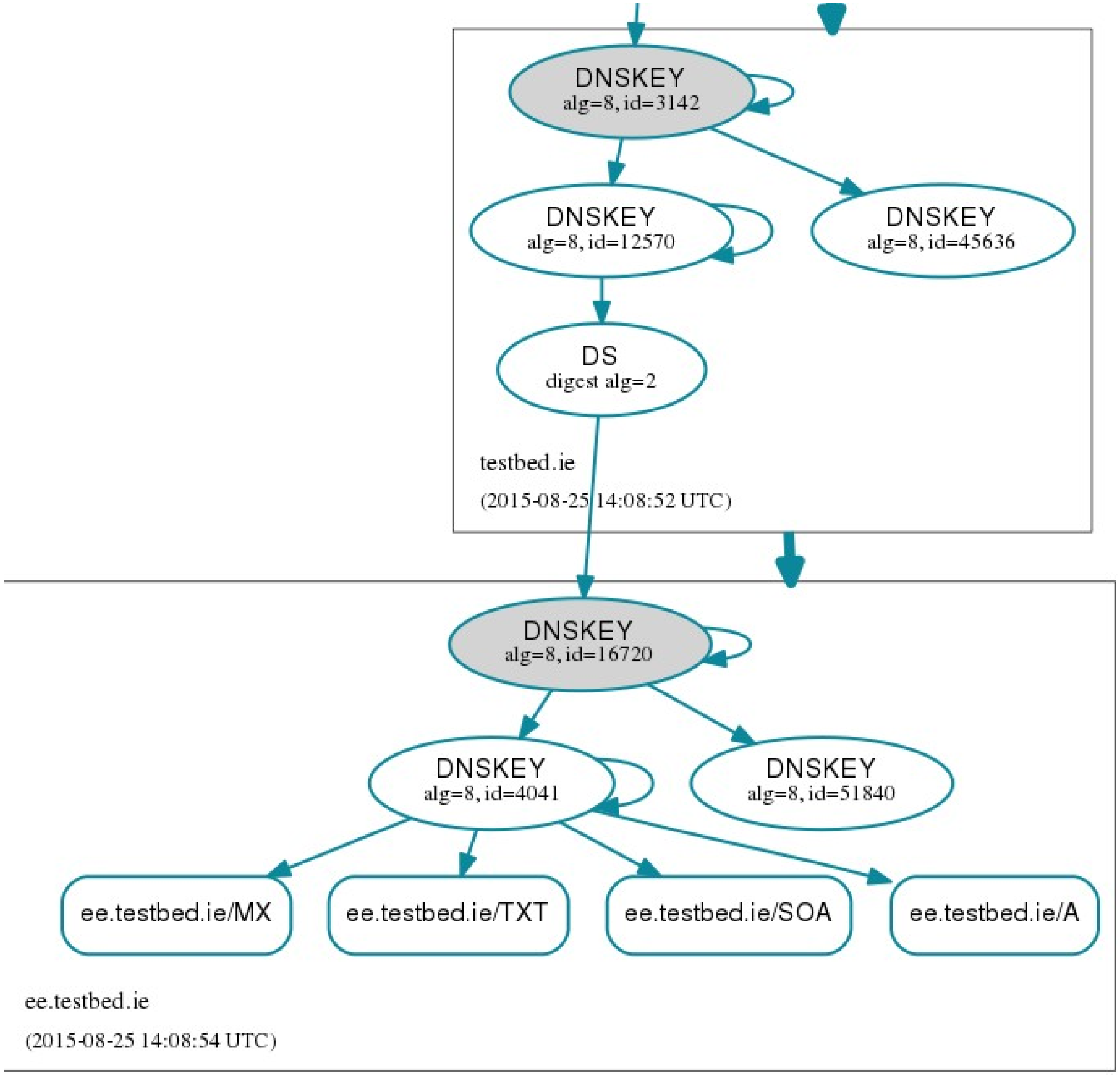
NS1
(jell.ie)

request staging
Child - zone signing, KSK & ZSK generation
Parent – add child to named.conf.local, add DS to zonefile, zone signing

NS2
(down.dsg.cs.tcd.ie)

request staging
Re-configure named.conf.local to add slaves
Secondary DNS server

PoC Pictures



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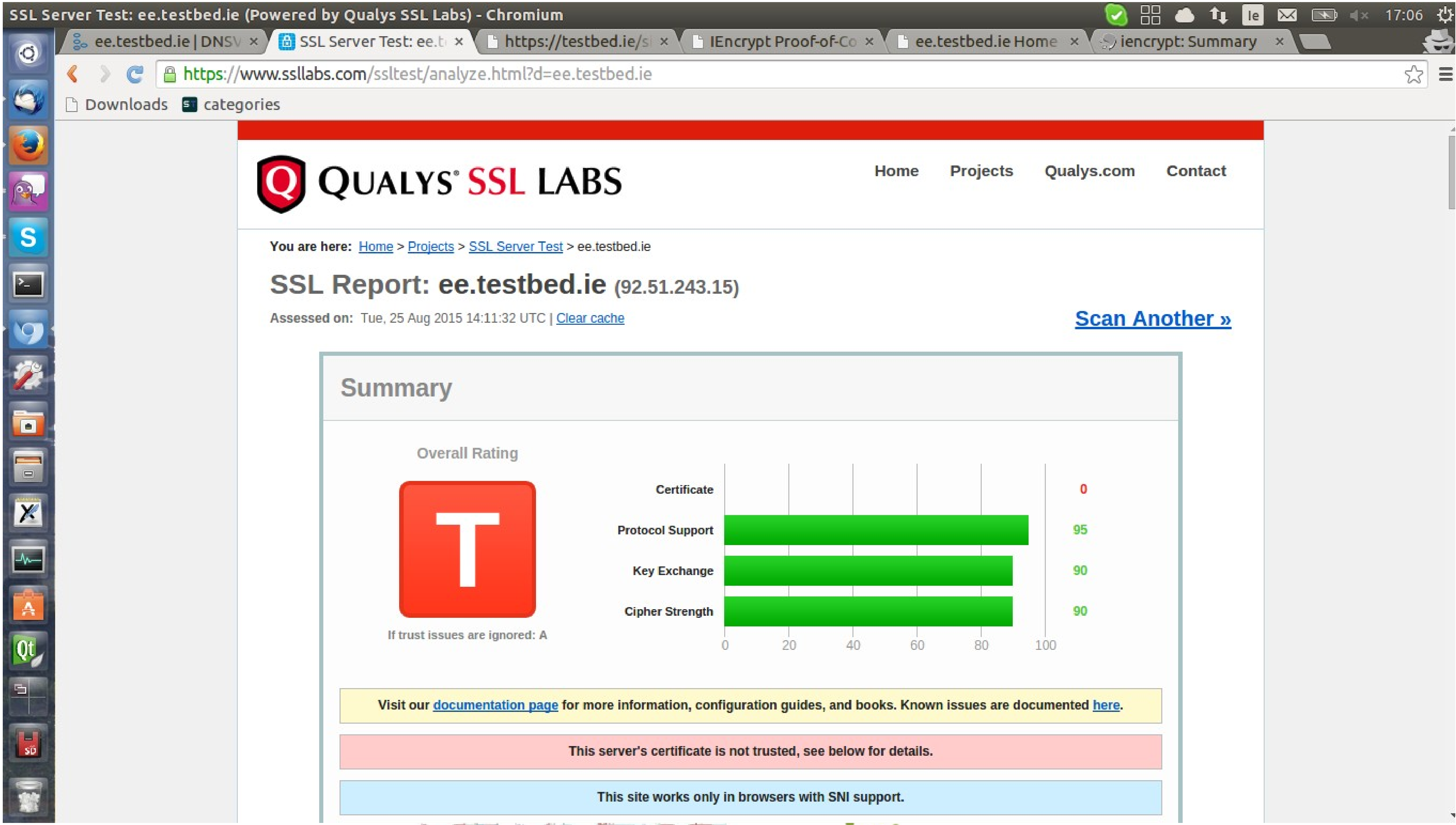
PoC Pictures



You are here: Home > Projects > SSL Server Test > ee.testbed.ie

SSL Report: ee.testbed.ie (92.51.243.15)

Assessed on: Tue, 25 Aug 2015 14:11:32 UTC | Clear cache

Scan Another »

Summary

Overall Rating

T

If trust issues are ignored: A

Certificate	0
Protocol Support	95
Key Exchange	90
Cipher Strength	90

Visit our documentation page for more information, configuration guides, and books. Known issues are documented here.

This server's certificate is not trusted, see below for details.

This site works only in browsers with SNI support.

Conclusion

- It is entirely possible to make DNSSEC useful and easy (actually invisible) to help more web sites use HTTPS today automatically and for free
- Invisible security like this should become the norm
- Once ubiquitous, similar automation can be done for other things (SMTP/DANE)
- Registrars who are hosters and (esp. ccTLD) registries are well positioned to help and be key to success

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Thanks!

Questions?

Contact

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Backup Slides

Future Goals

- Handle more kinds of hosting
- Help existing domains to use TLS at renewal time
- SMTP/STARTTLS with DANE

PoC Software

- Off-the-shelf:
  - Ubuntu 14.04, Bind (9.9.5), Apache (2.4.7)
  - **dnssec-tools (2.0.0, zonesigner, rollerd)**
  - **letsencrypt client (0.1)**
  - openssl (1.01f), curl (7.35.0), php (5.5.9), bash (4.3.11)
- Chewing gum and string:
  - **IEncrypt scripts, some via cron, some as root**

PoC repos

- Chewing gum, string and docs (this mainly)
  - https://basil.dsg.cs.tcd.ie/code/tcd/iencrypt
- Letsencrypt client
  - https://github.com/letsencrypt/letsencrypt

PoC Workflow - Registrant

- Registrant requests foo.testbed.ie at testbed.ie
  - If invalid, error
  - If being processed – say to wait

    else foo.testbed.ie added to “inwork” list
- If not ready, return esimated seconds until ready
  - If ready, return link to https://foo.testbed.ie
- Non-error HTML response pages autorefresh every N seconds
  - N = uniform random between 5 and 15

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PoC Workflow - DNSSEC

- (every 5 mins) NS1/children grabs list of new children from testbed.ie
  - Via mutually-authenticated (client-cert) TLS and “hidden” SNI
  - If valid, generates new zonefile, KSK/ZSK and DS
  - Signs Zonefile
- (every 5 mins) NS1/parent grabs list of new children (via file system)
  - Adds DS to parent zone and re-signs
  - Add children to named.conf.local
  - Pushes child to NS2/parent via mutually-authenticated (client-cert) TLS and “hidden” SNI
    - Ready to add new slave
  - Pushes child to testbed.ie via mutually-authenticated (client-cert) TLS and “hidden” SNI
    - Ready to start webcfg client processing (next slide)
  - Re-starts BIND
- (every 5 mins) NS2/parent grabs list of new children from file system
  - Via mutually-authenticated (client-cert) TLS and “hidden” SNI
  - Add children as new slaves to named.conf.local
  - Re-starts BIND

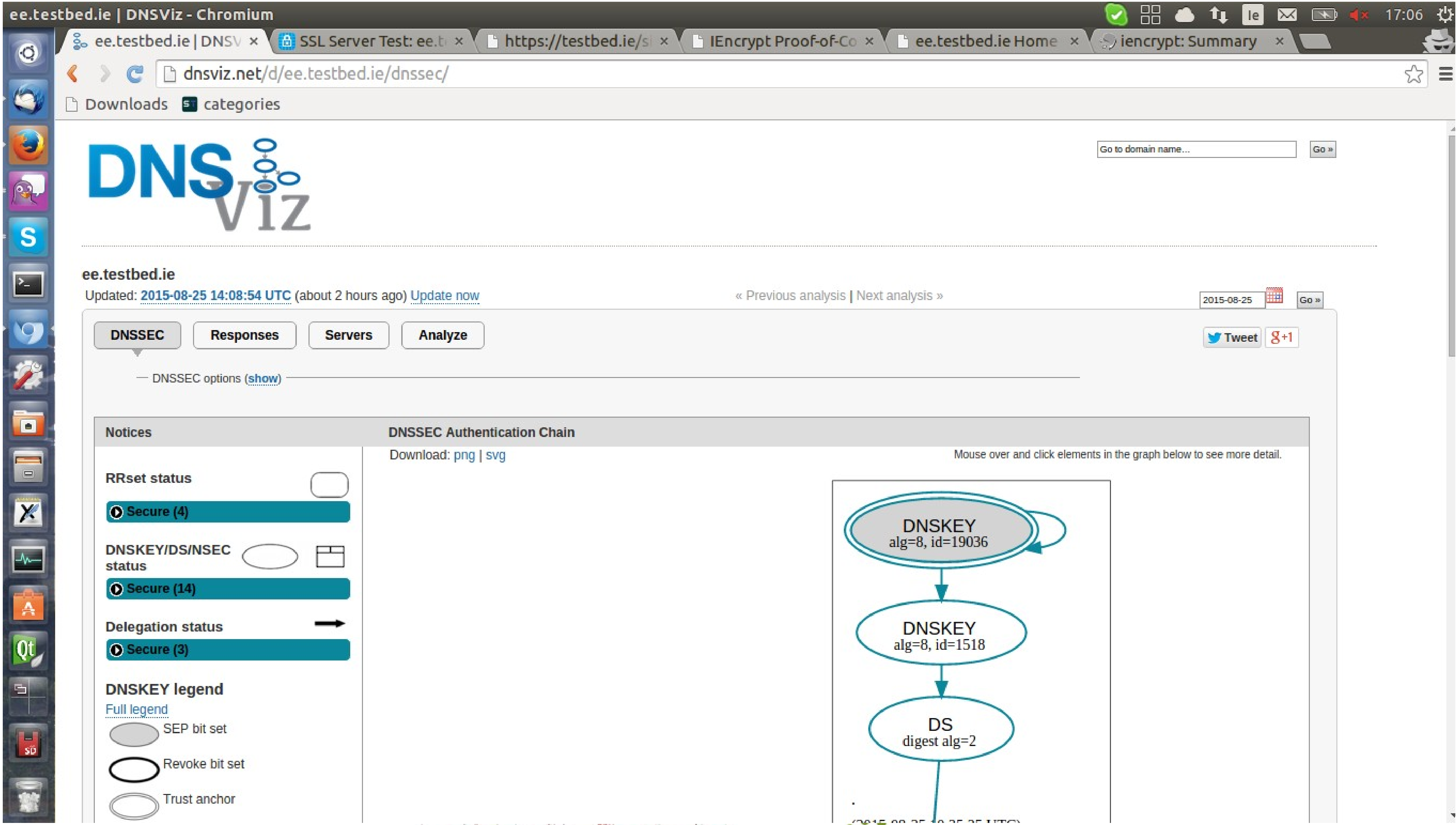
PoC Workflow - ACME

- ACME is the protocol used between LE client and CA service, implemented by letsencrypt client, so once DNSSEC is done...
- (Every 5 minutes) webcfg checks what children to process
- LE client generates key pair for authorization and account handling (for foo.testbed.ie)
- LE client authorizes itself to LE service for foo.testbed.ie
  - Currently via “standalone” option
    - Requires IEncrypt briefly stopping apache on testbed.ie
  - LE client generates new key pair for foo.testbed.ie web server and requests certificate
  - LE service issues certificate
- IEncrypt re-starts apache and sets status of foo.testbed.ie to ready
- Registrant

PoC Restrictions

- LE service today uses fake CA, “happy hacker fake CA”
    - https://basil.dsg.cs.tcd.ie/code/tcd/iencrypt/file/1af04b181fea/testbed.ie/acme/happy-hacker-fake-CA.pem
- Standalone authoritzation used
    - No DNS, or DNSSEC, DNS is on the way from LE though
    - We'll be signing anyway, we may need to help them verify that the DNS challenge response is from a signed zone
    - Means testbed.ie web server is done now and then for a few seconds
- No port 80 for testbed.ie or <foo>.testbed.ie just due to sharing the same apache install with hoba.ie, hence no HSTS etc. PoC children only ever run on 443

PoC Pictures



ee.testbed.ie | DNSViz - Chromium

17:06

ee.testbed.ie | DNSV × | SSL Server Test: ee.t × | https://testbed.ie/s × | IEncrypt Proof-of-Co × | ee.testbed.ie Home × | iencrypt: Summary ×

dnsviz.net/d/ee.testbed.ie/dnssec/

Downloads | categories

Go to domain name... Go »

ee.testbed.ie

Updated: 2015-08-25 14:08:54 UTC (about 2 hours ago) Update now

« Previous analysis | Next analysis »

2015-08-25 Go »

DNSSEC | Responses | Servers | Analyze

Tweet | +1

— DNSSEC options (show) —

Notices

RRset status

Secure (4)

DNSKEY/DS/NSEC status

Secure (14)

Delegation status

Secure (3)

DNSKEY legend

Full legend

SEP bit set

Revoke bit set

Trust anchor

DNSSEC Authentication Chain

Download: png | svg

Mouse over and click elements in the graph below to see more detail.

DNSKEY
alg=8, id=19036

DNSKEY
alg=8, id=1518

DS
digest alg=2

.

(2015-08-25 10:35:35 UTC)

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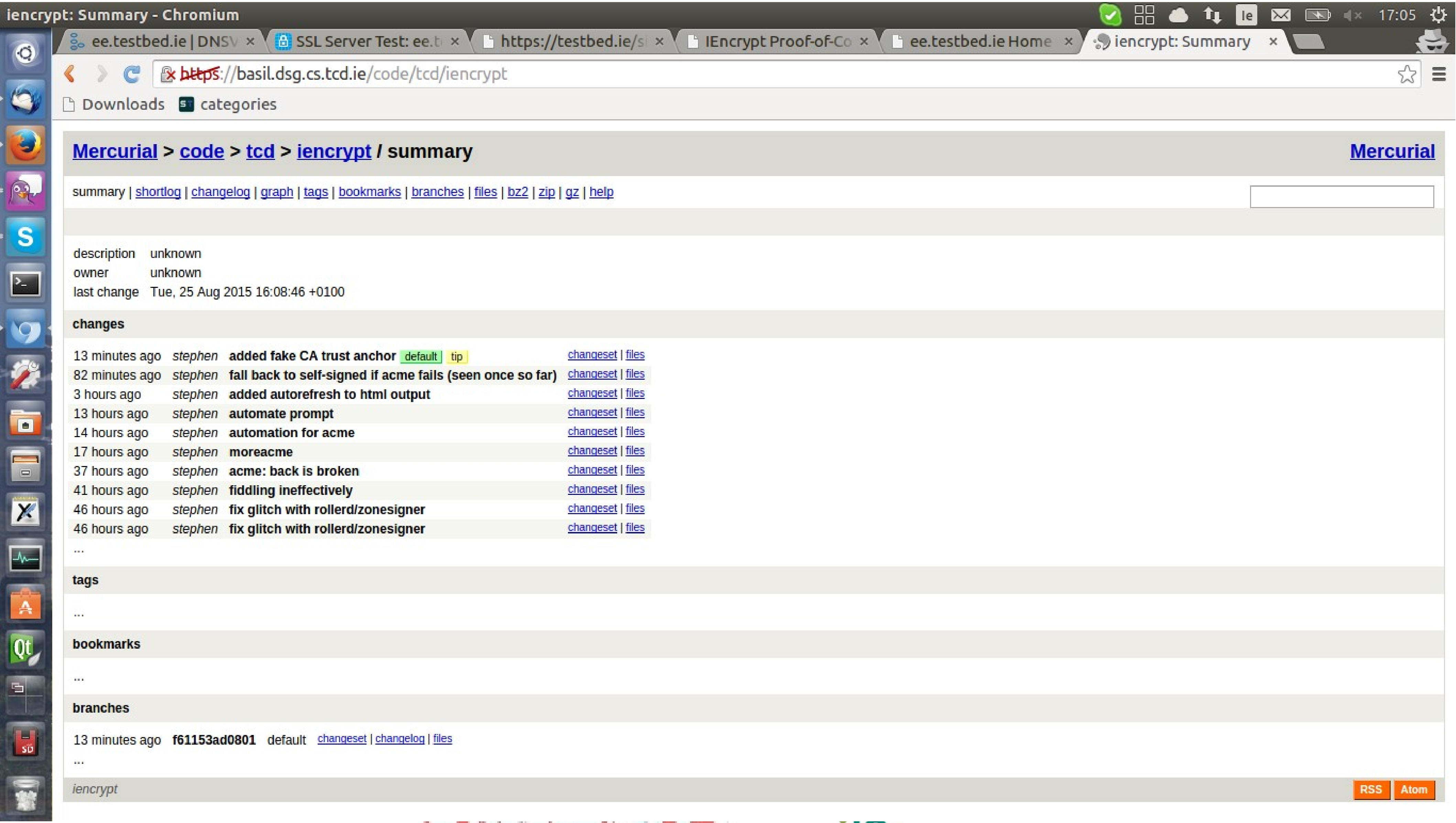
PoC pictures



Mercurial > code > tcd > iencrypt / summary **Mercurial**

summary | shortlog | changelog | graph | tags | bookmarks | branches | files | bz2 | zip | gz | help

description	unknown
owner	unknown
last change	Tue, 25 Aug 2015 16:08:46 +0100

changes

13 minutes ago	*stephen*	**added fake CA trust anchor** default tip	changeset | files
82 minutes ago	*stephen*	**fall back to self-signed if acme fails (seen once so far)**	changeset | files
3 hours ago	*stephen*	**added autorefresh to html output**	changeset | files
13 hours ago	*stephen*	**automate prompt**	changeset | files
14 hours ago	*stephen*	**automation for acme**	changeset | files
17 hours ago	*stephen*	**moreacme**	changeset | files
37 hours ago	*stephen*	**acme: back is broken**	changeset | files
41 hours ago	*stephen*	**fiddling ineffectively**	changeset | files
46 hours ago	*stephen*	**fix glitch with rollerd/zonesigner**	changeset | files
46 hours ago	*stephen*	**fix glitch with rollerd/zonesigner**	changeset | files

...

tags

...

bookmarks

...

branches

13 minutes ago **f61153ad0801** default changeset | changelog | files

...

iencrypt RSS Atom

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