

cryptdomainmgr

automating Cert, TLSA, DKIM and many more

Stefan Helmert

<https://www.entroserv.de/de/offene-software/cryptdomainmgr>

20.04.2019

Content

Motivation

- fine
- not so fine

Basics

- SSL Certificate
- TLSA
- CAA
- DNSSEC
- DANE – all steps
- MX
- DKIM
- additional DNS records
- DKIM – overview

Cryptdomainmgr

- dataflow
- autorenew process
- structure

Usage

- update cycle
- DNS credential
- Certificates
- DKIM
- Domain

Implementation

- cryptdomainmgr
- modules
- simpleloggerplus
- dnsuptools

Discussion

Motivation

→ **let's make a web app** ←

- ▶ DNS
- ▶ Webpage
- ▶ E-Mail
- ▶ Mailinglist
- ▶ **and the s for security**

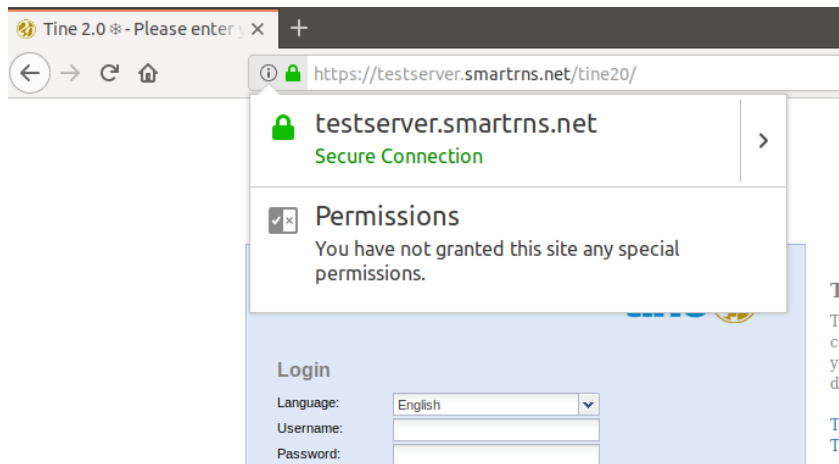
DeMotivation

→ **let's make a web app** ←

- ▶ DNS
 - ▶ SOA
 - ▶ DNSSEC
- ▶ Webpage
 - ▶ HTTPS
 - ▶ Certificate
 - ▶ HSTS
 - ▶ SRV
 - ▶ TLSA
- ▶ E-Mail
 - ▶ Spam
 - ▶ DKIM
 - ▶ SPF
 - ▶ ADSP
 - ▶ DMARC
 - ▶ SRV
- ▶ Mailinglist
 - ▶ SRS
 - ▶ ARC

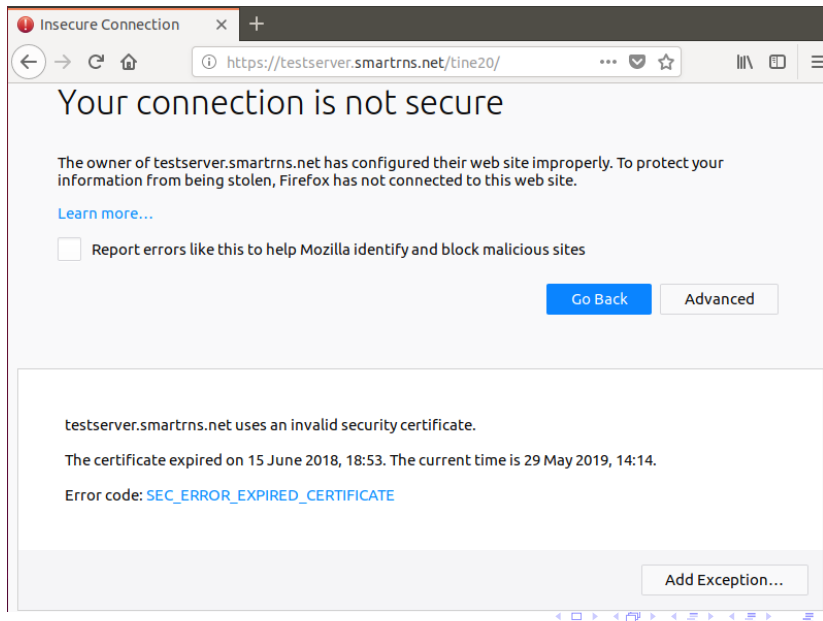
DeMotivation

fine



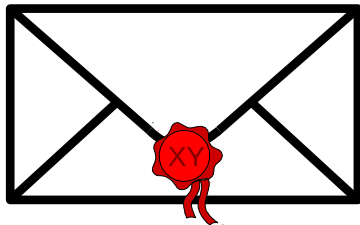
DeMotivation

not so fine



Basics

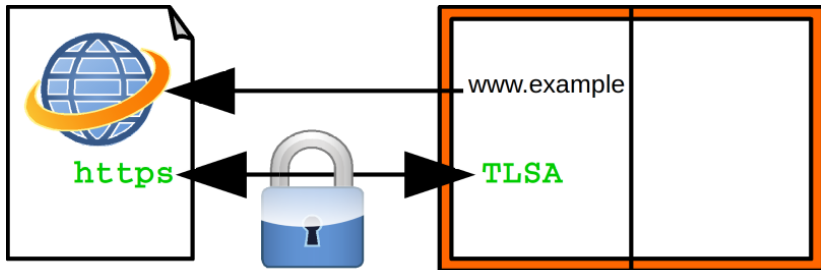
SSL Certificate



- ▶ authentication (phishing)
- ▶ integrity (man in the middle)
- ▶ privacy (spy)

→ certbot renew

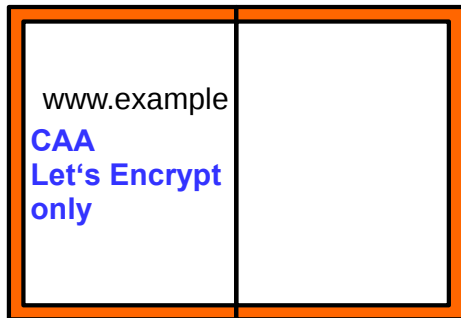
DANE – DNS-based Authentication of Named Entities



TLSA – Transport Layer Security Authentication

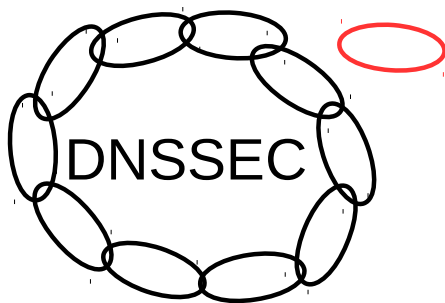
- ▶ locks certificate to domain/DNS (fraudulent CA, stolen cert)

→ to do



CAA – Certification Authority Authorization

- ▶ specifies allowed CA
- ▶ checked by CA



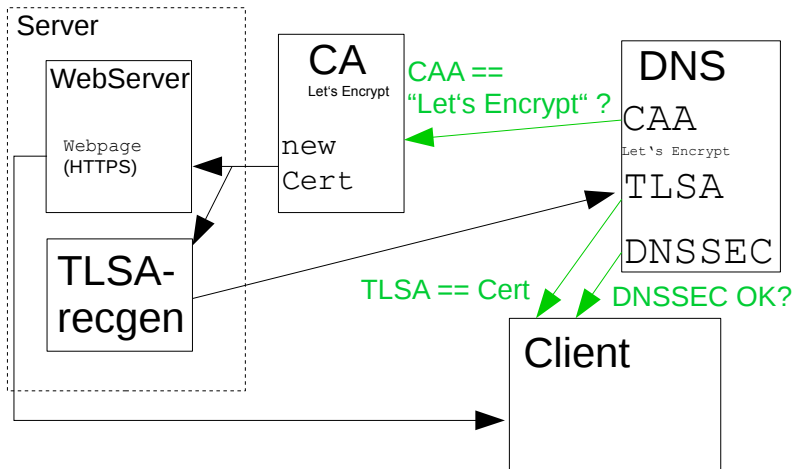
Domain Name System Security Extensions

- ▶ authenticate domain owner
- ▶ integrity (DNS cache poisoning)
- ▶ proof of nonexistence

→ done by domain provider

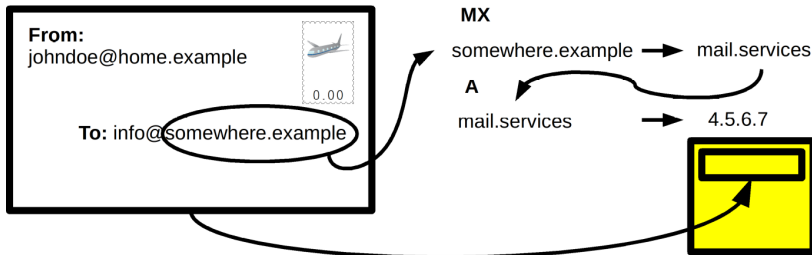
Basics

DANE – all steps



Basics

MX



Mail eXchange

- ▶ abstraction: email domain, email server domain
- ▶ multiple email servers

Basics

DKIM



DomainKeys Identified Mail

- ▶ authenticate MTA (fake/spam server)
- ▶ integrity (man in the middle)

→ to do

Basics

additional DNS records

SPF – Sender Policy Framework

- ▶ which server is allowed to send email

ADSP – Author Domain Signing Practices

- ▶ defines, if email must be DKIM signed

DMARC – Domain-based Message Authentication, Reporting and Conformance

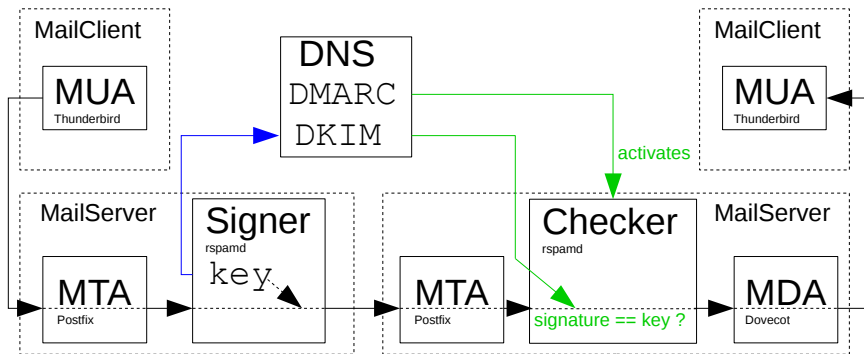
- ▶ successor of SPF and ADSP
- ▶ overrides SPF and ADSP
- ▶ additional parameters: report email

SRV – Service

- ▶ announces services

Basics

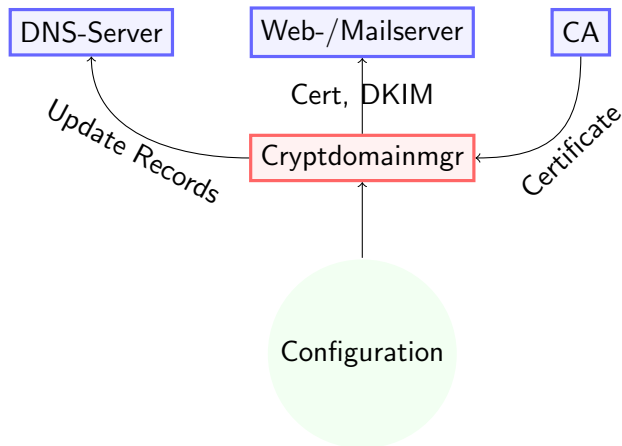
DKIM – overview



Cryptdomainmgr

dataflow

Infrastructure as Code!



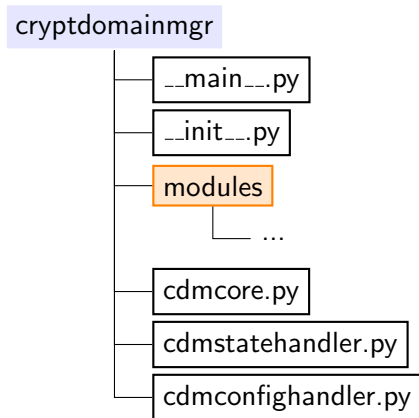
Cryptdomainmgr

autorenew process

- ▶ prepare
 - ▶ generate certificate
 - ▶ calculate TLSA from certificate
 - ▶ add TLSA RR
 - ▶ generate key pair for DKIM
 - ▶ calculate DKIM
 - ▶ add DKIM RR
- ▶ rollover
 - ▶ use new certificate
 - ▶ use new DKIM key
- ▶ cleanup
 - ▶ remove old TLSA RR
 - ▶ remove old DKIM RR
 - ▶ delete old certificates
 - ▶ delete old DKIM keys

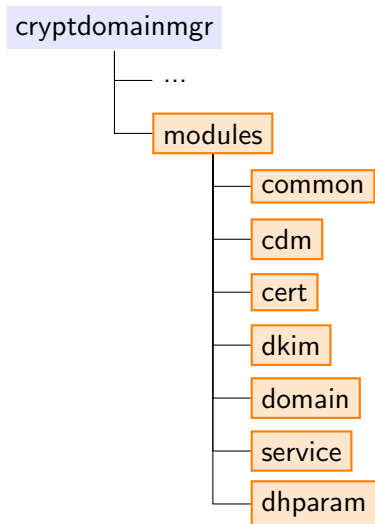
Cryptdomainmgr

structure



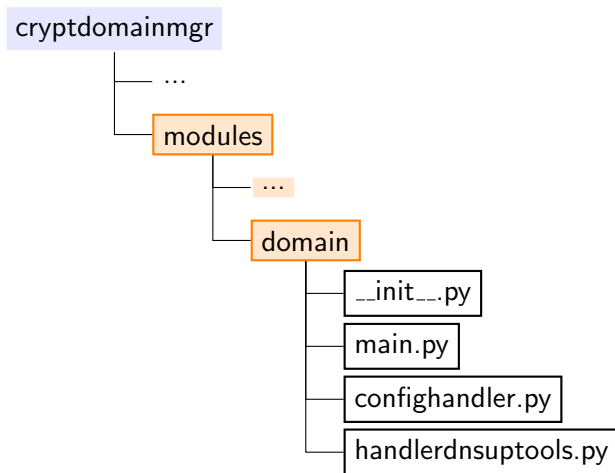
Cryptdomainmgr

structure



Cryptdomainmgr

structure



Usage

`www.entroserv.de/de/offene-software/cryptdomainmgr`



Usage

update cycle

update – set static entries: a, aaaa, srv, dmarc, spf, adsp

```
$ python -m cryptdomainmgr --update cred.cnf exmpl.cnf
```

prepare, rollover, cleanup cycle – renew cryptographic material: certificate, TLSA, DKIM

```
$ python -m cryptdomainmgr cred.cnf exmpl.cnf
```

explicit cycle

```
$ python -m cryptdomainmgr --prepare cred.cnf exmpl.cnf
```

```
$ python -m cryptdomainmgr --rollover cred.cnf exmpl.cnf
```

```
$ python -m cryptdomainmgr --cleanup cred.cnf exmpl.cnf
```

Usage

DNS credential

```
$ cat cred.cnf
```

```
[domain]  
user = myusername  
passwd = mypassword
```

Usage

Certificates

```
$ cat exmpl.cnf
```

```
[cert]
```

```
handler = dehydrated
```

```
email = stefan.helmert@t-online.de
```

```
keysize = 4096
```

```
[cert:maincert]
```

```
destination = /etc/ssl
```

```
extraflags = --staging, -x
```

```
certname = fullchain.pem
```

- ▶ multiple domains using maincert → SAN certificate

Usage

DKIM

```
$ cat exmpl.cnf
```

```
[dkim]
```

```
handler = rspamd
```

```
[dkim:maindkim]
```

```
signingConfTemplateFile
```

```
    = /etc/cryptdomainmgr/dkim_signing_template.conf
```

```
signingConfDestinationFile
```

```
    = /etc/rspamd/local.d/dkim_signing.conf
```

Usage

Domain

```
$ cat exmpl.cnf
```

```
[domain]
```

```
user = myusername
```

```
handler = dnsuptools/inwx
```

```
[domain:domain.example]
```

```
soa.hostmaster = stefan.helmert@t-online.de
```

```
soa.refresh = 7200
```

```
[domain:sub.domain.example]
```

```
ip4 = auto, 192.168.0.1
```

```
ip6+ = auto, 0ffc::0030
```

```
mx = mail20.domain.example:20, mail30.domain.example:30
```

```
mx.40 = mail40.domain.example, mail50.domain.example:50
```

```
mx.10+= mail10.domain.example
```

Usage

Domain

set **A** record

```
$ cat exmpl.cnf
```

```
[domain:sub.domain.example]  
ip4 = auto, 192.168.0.1
```

means:

- ▶ add external ip and 192.168.0.1 to sub.domain.example
- ▶ delete all other A records of sub.domain.example

Usage

Domain

add A record

```
$ cat exmpl.cnf
```

```
[domain:sub.domain.example]  
ip4+ = auto, 192.168.0.1
```

means:

- ▶ add external ip and 192.168.0.1 to sub.domain.example
- ▶ ~~delete all other A records of sub.domain.example~~

Usage

Domain

set MX record

```
$ cat exmpl.cnf
```

```
[domain:sub.domain.example]
```

```
mx = mail20.domain.example:20, mail30.domain.example:30
```

means:

- ▶ add MX records
 - ▶ mail20.domain.example with prio 20
 - ▶ mail30.domain.example with prio 30
- ▶ delete all other MX records from sub.domain.example

Usage

Domain

set MX record

```
$ cat exmpl.cnf
```

```
[domain:sub.domain.example]
```

```
mx.40 = mail40.domain.example, mail50.domain.example:50
```

means:

- ▶ add MX records
 - ▶ mail40.domain.example with prio 40
 - ▶ mail50.domain.example with prio 50
- ▶ delete all other MX records with prio 40 from sub.domain.example

Usage

Domain

set SRV record

```
$ cat exmpl.cnf
```

```
[domain:sub.domain.example]  
srv.service.proto.port.weight.prio  
    = sub.domain.example:PRIORITY:WEIGHT:PORT:PROTO:SERVICE
```

set DMARC entries

```
$ cat exmpl.cnf
```

```
[domain:sub.domain.example]  
dmarc.p = quarantine  
dmarc.rua = mailto:stefan.helmert@t-online.de  
dmarc.ruf = mailto:stefan.helmert@gmx.net
```

- ▶ changes the entries p, rua, ruf of the DMARC record
- ▶ entries adkim, aspf, pct do not change
- ▶ „atomic“ operation
- ▶ only one DMARC record allowed!

Usage

Domain

set DMARC record

```
$ cat exmpl.cnf
```

```
[domain:sub.domain.example]
dmarc =
dmarc.p = quarantine
dmarc.rua = mailto:stefan.helmert@t-online.de
dmarc.ruf = mailto:stefan.helmert@gmx.net
```

- ▶ changes the entries p, rua, ruf of the DMARC record
- ▶ remove all other entries of this record
- ▶ atomic operation
- ▶ at most one DMARC record allowed!

set SOA entries

```
$ cat exmpl.cnf
```

```
[domain:domain.example]  
soa.hostmaster = stefan.helmert@t-online.de  
soa.refresh = 7200
```

- ▶ changes the entries hostmaster, refresh of the SOA record
- ▶ primns, serial, retry, expire, ncttl not changed
- ▶ atomic operation
- ▶ exact one SOA record in top level allowed!

Usage

Domain

set SPF flags

```
$ cat exmpl.cnf
```

```
[domain:domain.example]  
spf = -mx, a, ?all, +aaaa
```

- ▶ add given flags to SPF record
- ▶ remove all other flags from SPF record
- ▶ atomic operation
- ▶ at most one SPF record is allowed!

Usage

Domain

set ADSP and CAA records

```
$ cat exmpl.cnf
```

```
[domain:domain.example]
adsp = all
caa =    0 issue letsdecrypt.org,
        128 issuewild examplecert.example
```

- ▶ atomic update ADSP record
- ▶ add the CAA records
- ▶ remove all other CAA records

configured by cert handler:

```
[domain:domain.example]
caa =    auto
```

Usage

Domain

combine stuff – TLSA and DKIM

```
$ cat exmpl.cnf
```

```
[domain:sub.domain.example]
tlsa.tcp.443 = auto:3:0:1, auto:2:0:1
cert = maincert
dkim = maindkim
```

prepare cycle

- ▶ add TLSA and DKIM records

rollover cycle

- ▶ no DNS changes
- ▶ apply certificates and keys on server

cleanup cycle

- ▶ add TLSA and DKIM records (again)
- ▶ remove all other TLSA and DKIM records

Implementation

cryptdomainmgr

`__main__.py` command line interface

`cdmcore.py` core, brings everything together

`cdmconfighandler.py` reads/interpretes config (ini) files

`cdmstatehandler.py` manages dependencies, data transport, next run phase

`modules/` plugins handling/interfacing dns update, certificate renewal, dkim renewal, service reload

external packages:

`simpleloggerplus` logging abstraction, password → *****

`dnsuptools` domrobot interface abstraction, TLSA, DKIM calculation

Implementation

cryptdomainmgr

Reactive: Domain update depends on TLSA record calculated based on new certificate.

modules/cert

Certificate Update

modules/domain

Update Domain

Update Domain

TLSA



Implementation

modules

`modules/cert/main.py` interface to handler, some helpers

`modules/cert/handlerdehydrated.py` interface to dehydrated to
create certificate

`modules/cert/confighandler.py` interpretes corresponding parts of the
config file

external package:

`dehydrated` handles acme api for letsencrypt

Implementation

simpleloggerplus

simpleloggerplus.py core, produces output

deepops.py deep dict/list operations, password → *****

Implementation

dnsuptools

[dnsuptools.py](#) core, high level, record change & query methods

[dnsupdate.py](#) interface to wrapper, low level

[inwxwrapper.py](#) interface to internetworx api, lowest level

[dkimrecgen.py](#) reads/interpretes dkim key file

[tlsarecgen.py](#) reads/interpretes certificate file

[dnshelpers.py](#) one helper function

external packages:

[simpleloggerplus](#) see simpleloggerplus 3

[inwxclient](#) domrobot client

Discussion

???