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 Certifcate
  - TLSA
  - CAA
  - DNSSEC
  - DANE – all steps
  - MX
  - SPF
  - 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**

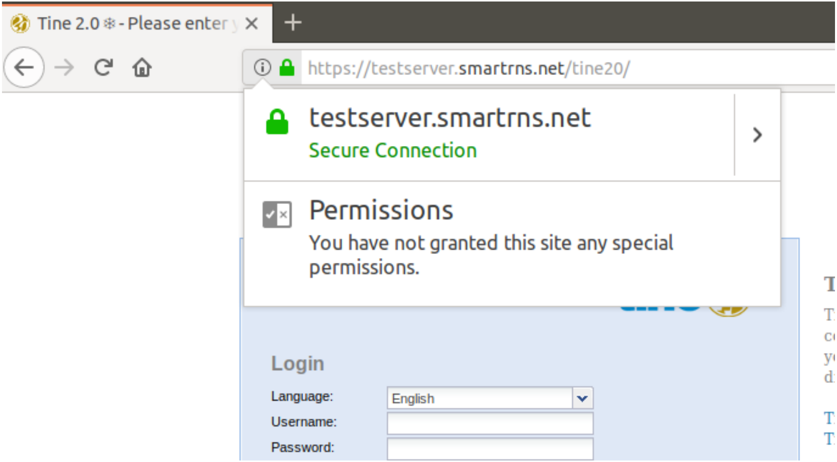
DeMotivation

→ **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



Tine 2.0 - Please enter

https://testserver.smartrns.net/tine20/

testserver.smartrns.net

Secure Connection

Permissions

You have not granted this site any special permissions.

Login

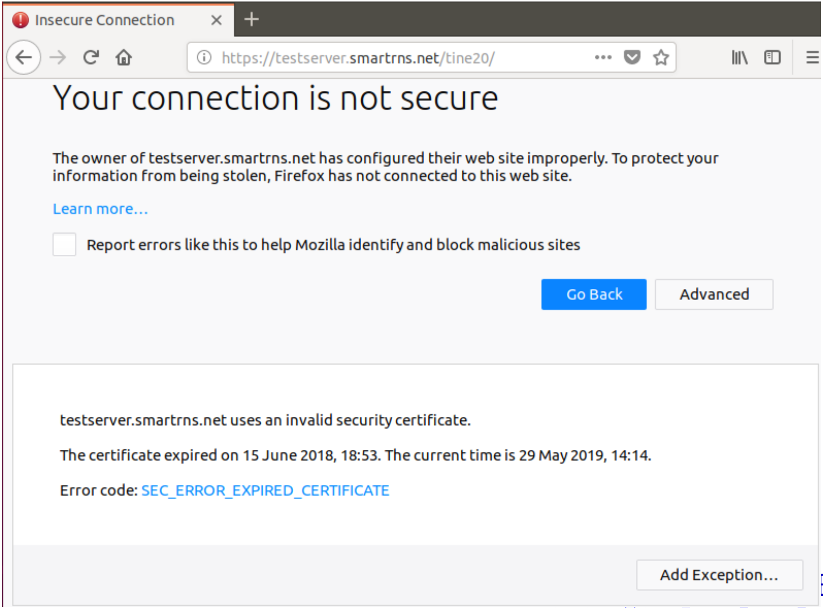
Language: English

Username:

Password:

DeMotivation

not so fine



Your connection is not secure

The owner of testserver.smartrns.net has configured their web site improperly. To protect your information from being stolen, Firefox has not connected to this web site.

Learn more…

□ Report errors like this to help Mozilla identify and block malicious sites

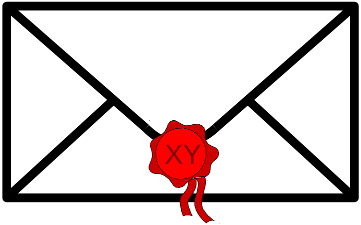
testserver.smartrns.net uses an invalid security certificate.

The certificate expired on 15 June 2018, 18:53. The current time is 29 May 2019, 14:14.

Error code: SEC_ERROR_EXPIRED_CERTIFICATE

Basics

SSL Certifcate



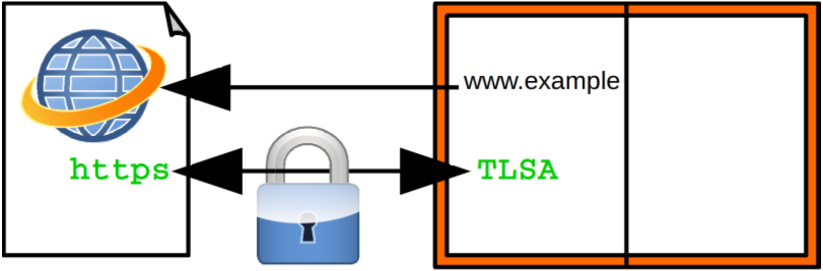
- authentication (phishing)
- integrity (man in the middle)
- privacy (spy)

→ certbot renew

Basics

TLSA

DANE – DNS-based Authentication of Named Entities



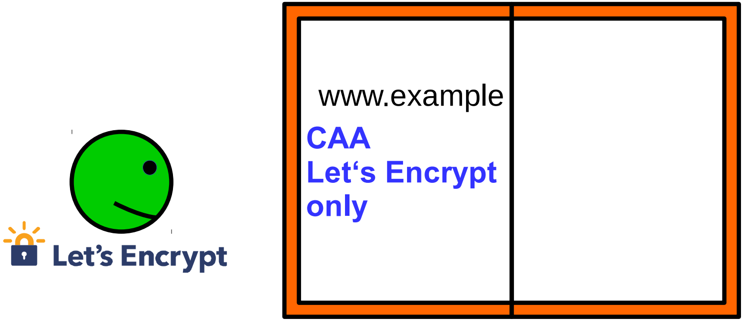
TLSA – Transport Layer Security Authentication

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

→ to do

Basics

CAA



www.example

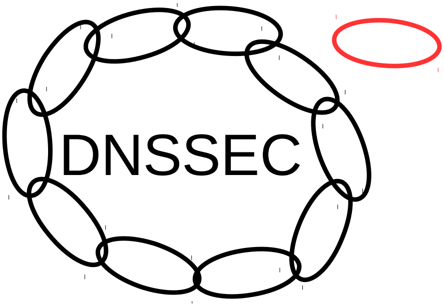
CAA
Let‘s Encrypt
only

CAA – Certification Authority Authorization

- specifies allowed CA
- checked by CA

Basics

DNSSEC



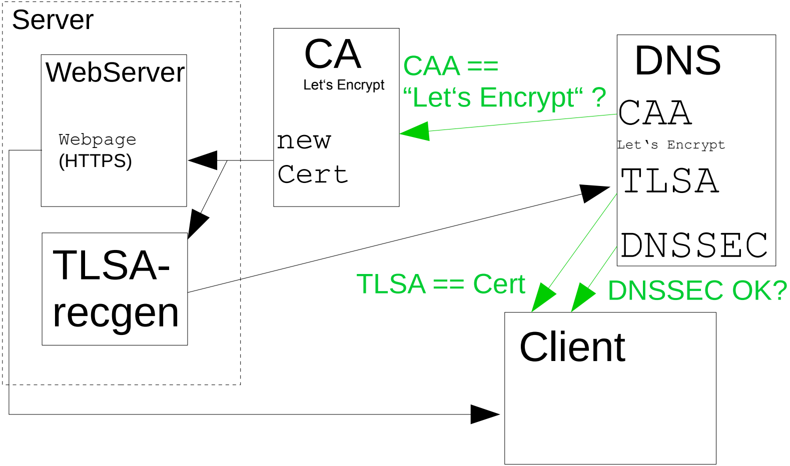
Domain Name System Security Extensions

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

→ done by domain provider

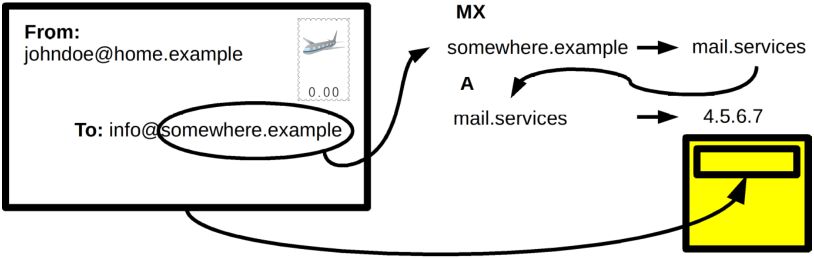
Basics

DANE – all steps



Basics

MX

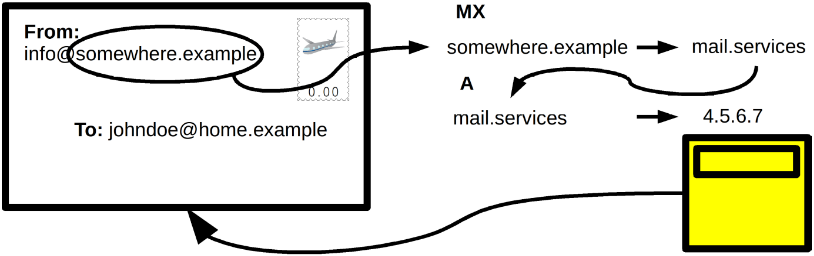


Mail eXchange

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

Basics

SPF

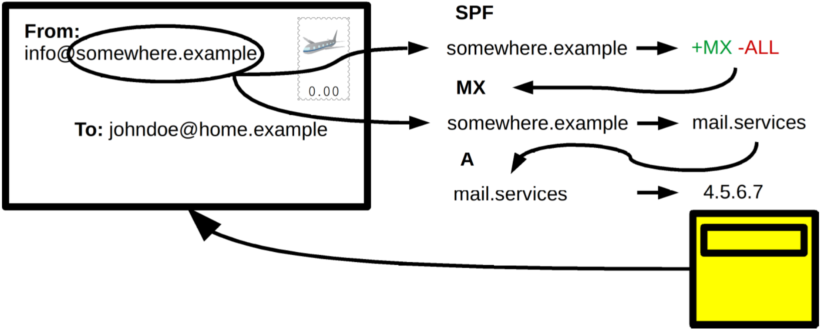


MX backwards

- faked sender?

Basics

SPF



SPF – Sender Policy Framework

- MX alled to send
- no one else allowed

Basics

DKIM

From:
johndoe@home.example
WhjsxQZtwdfGQW==
DKIM
0.00
To: info@somewhere.example

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

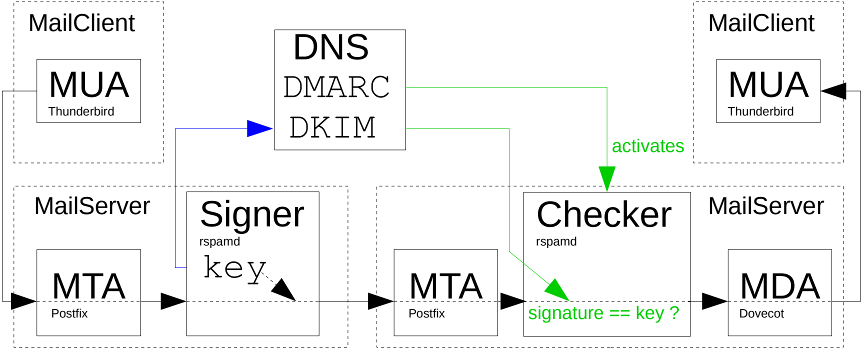
- successor of SPF and ADSP
- overrides SPF and ADSP
- additional parameters: report email

SRV – Service

- announces services

Basics

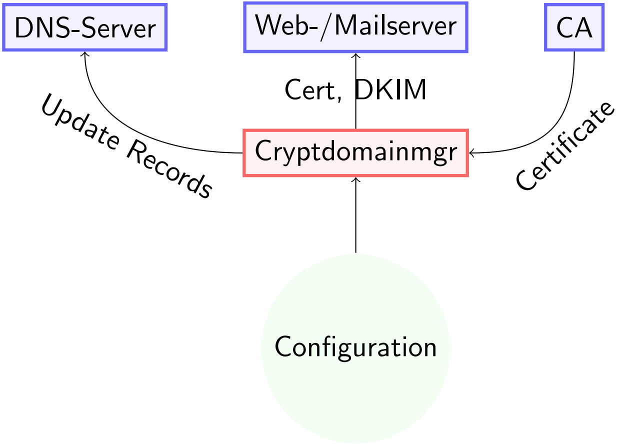
DKIM – overview



Cryptdomainmgr

dataflow

Infrastructure as Code!



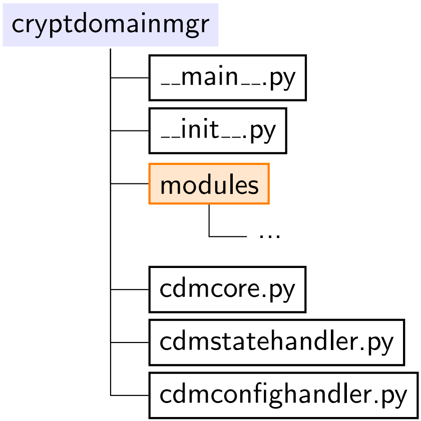
Cryptdomainmgr

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

__main__.py

__init__.py

modules

...

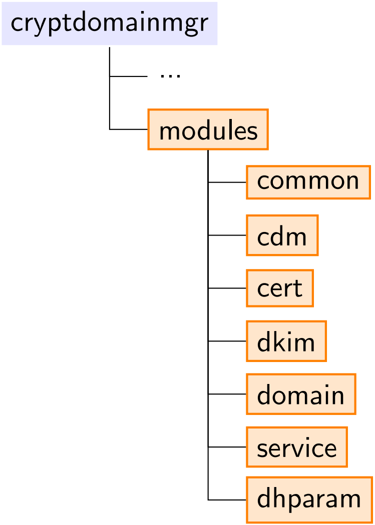
cdmcore.py

cdmstatehandler.py

cdmconfighandler.py

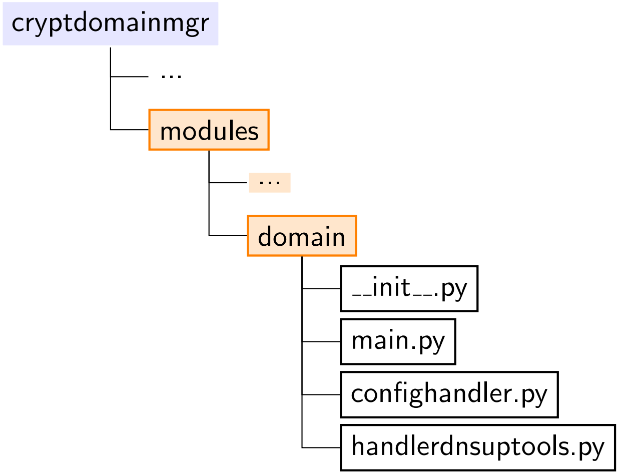
Cryptdomainmgr

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:PRIO:WEIGHT:PORT:PROTO:SERVICE
```

Usage

Domain

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!

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:

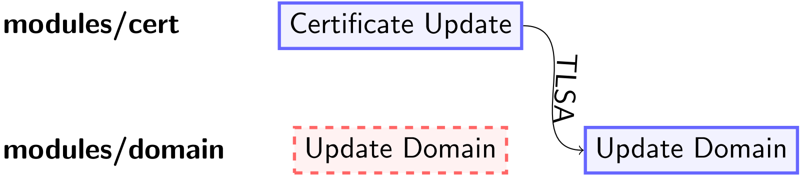
simpleloggerplus logging abstraction, password → *****

dnsuptools domrobot interface abstraction, TLSA, DKIM calculation

Implementation

cryptdomainmgr

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



Implementation

modules

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

modules/cert/handlerdehydrated.py interface todehydrated to create certificate

modules/cert/confighandler.py interpretes corrspondig 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

???