Apache httpd and TLS/SSL certificates validation

Jean-Frederic Clere

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What I will cover

- TLS and certificates/keys (clients and servers)
  - Basics
- Client certificates OCSP responder or CRL.
- Servers certificates
  - Signed by CA, let’s encrypt for example
  - mod_md to automate renewal
  - mod_md2 and OCSP stapling
- Demos
- Questions?

Who I am

Jean-Frederic Clere

Red Hat

Years writing JAVA code and server software

Tomcat committer since 2001

Doing OpenSource since 1999

Cyclist/Runner etc

Lived 15 years in Spain (Barcelona)

Now in Neuchâtel (CH)

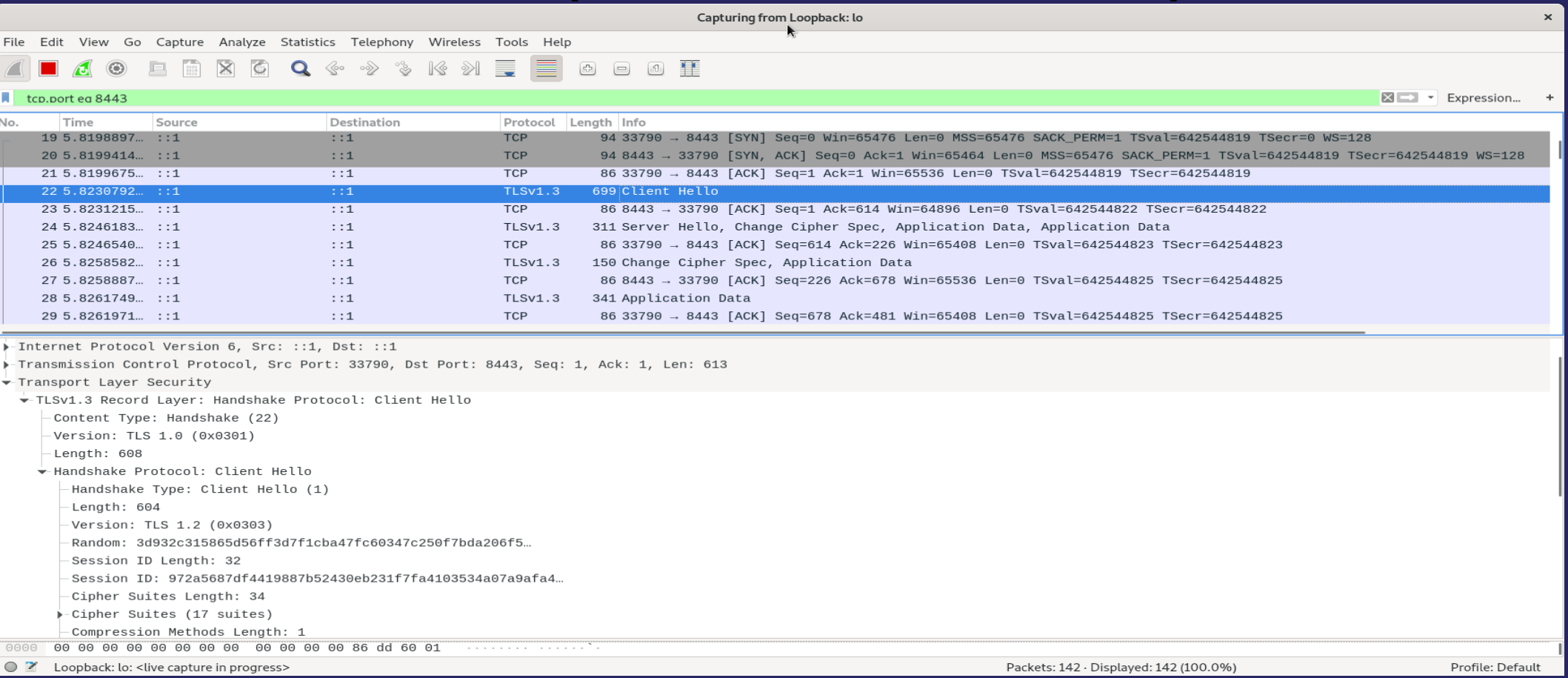
Key and Certificate

- A pair:
  - You keep the key secret
  - You “publish” the certificate
  - You identify your self in the certificate

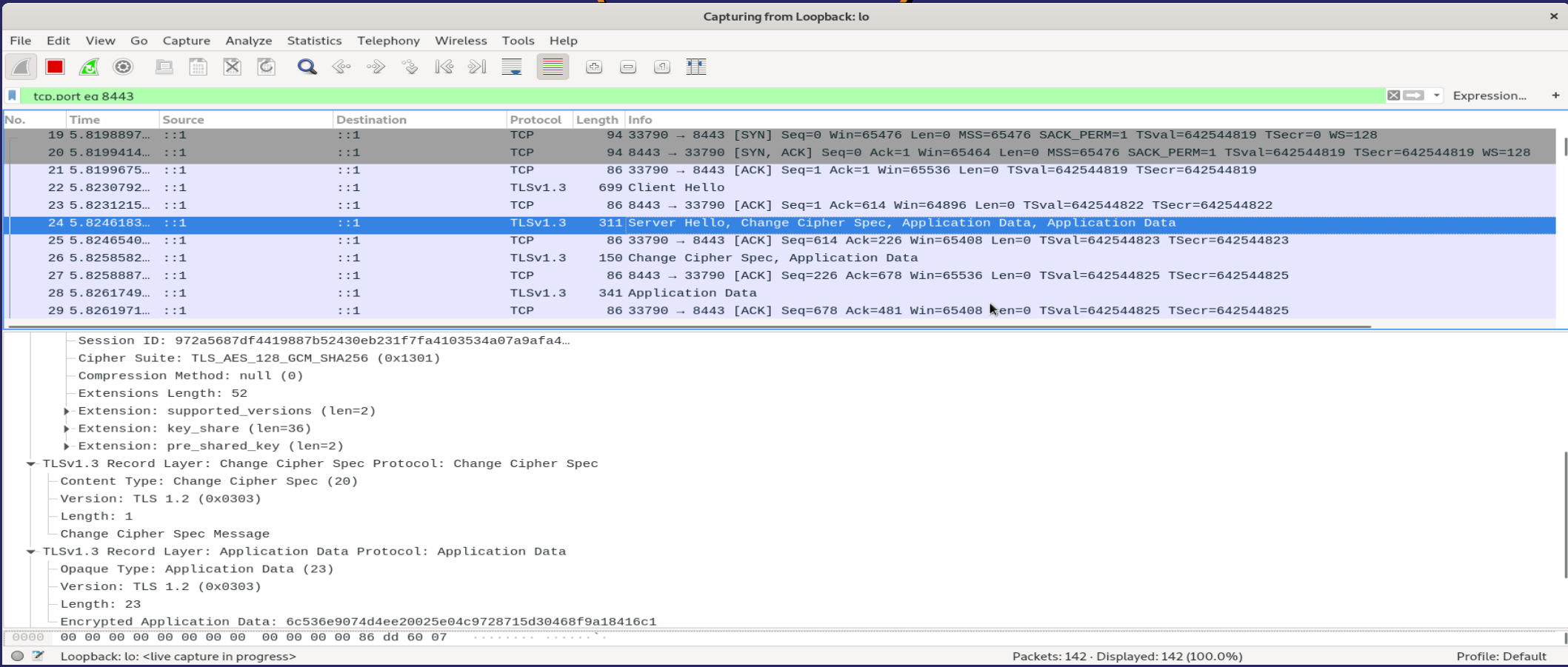
    Certificate authority

    Let’s encrypt
- How it works.

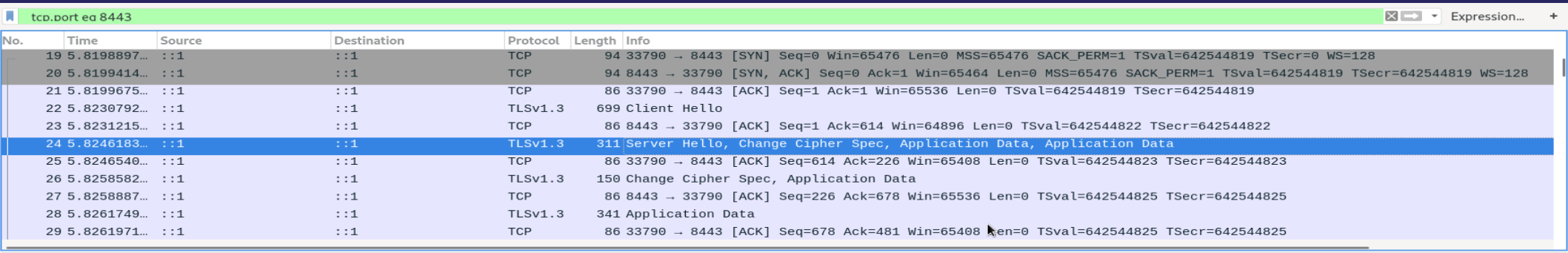
Client Hello (TLS 1.3 Firefox)

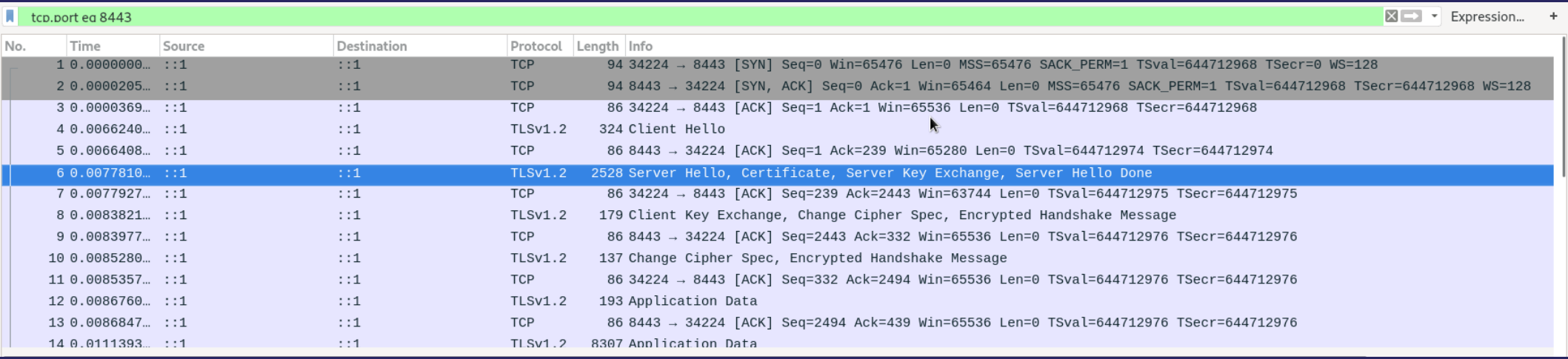


Server Hello (Tomcat)



TLS 1.3 versus 1.2





TLS 1.3 versus 1.2 (look into 1.2!)

tcp.port eq 8443 — Expression…

No.	Time	Source	Destination	Protocol	Length	Info
1	0.0000000…	::1	::1	TCP	94	34224 → 8443 [SYN] Seq=0 Win=65476 Len=0 MSS=65476 SACK_PERM=1 TSval=644712968 TSecr=0 WS=128
2	0.0000205…	::1	::1	TCP	94	8443 → 34224 [SYN, ACK] Seq=0 Ack=1 Win=65464 Len=0 MSS=65476 SACK_PERM=1 TSval=644712968 TSecr=644712968 WS=128
3	0.0000369…	::1	::1	TCP	86	34224 → 8443 [ACK] Seq=1 Ack=1 Win=65536 Len=0 TSval=644712968 TSecr=644712968
4	0.0066240…	::1	::1	TLSv1.2	324	Client Hello
5	0.0066408…	::1	::1	TCP	86	8443 → 34224 [ACK] Seq=1 Ack=239 Win=65280 Len=0 TSval=644712974 TSecr=644712974
6	0.0077810…	::1	::1	TLSv1.2	2528	Server Hello, Certificate, Server Key Exchange, Server Hello Done
7	0.0077927…	::1	::1	TCP	86	34224 → 8443 [ACK] Seq=239 Ack=2443 Win=63744 Len=0 TSval=644712975 TSecr=644712975
8	0.0083821…	::1	::1	TLSv1.2	179	Client Key Exchange, Change Cipher Spec, Encrypted Handshake Message
9	0.0083977…	::1	::1	TCP	86	8443 → 34224 [ACK] Seq=2443 Ack=332 Win=65536 Len=0 TSval=644712976 TSecr=644712976
10	0.0085280…	::1	::1	TLSv1.2	137	Change Cipher Spec, Encrypted Handshake Message
11	0.0085357…	::1	::1	TCP	86	34224 → 8443 [ACK] Seq=332 Ack=2494 Win=65536 Len=0 TSval=644712976 TSecr=644712976
12	0.0086760…	::1	::1	TLSv1.2	193	Application Data
13	0.0086847…	::1	::1	TCP	86	8443 → 34224 [ACK] Seq=2494 Ack=439 Win=65536 Len=0 TSval=644712976 TSecr=644712976
14	0.0111393…	::1	::1	TLSv1.2	8307	Application Data

```
▾ Handshake Protocol: Certificate
    Handshake Type: Certificate (11)
    Length: 2049
    Certificates Length: 2046
  ▾ Certificates (2046 bytes)
      Certificate Length: 1058
    ▸ Certificate: 3082041e30820306a003020102020900b94877ebce531bc6… (pkcs-9-at-emailAddress=jfclere@gmail.com,id-at-commonName=localhost,id-at-organizationalUnitName=ldap server,id-at-…
      Certificate Length: 982
    ▸ Certificate: 308203d2308202baa003020102020900b94877ebce531bb1… (pkcs-9-at-emailAddress=jfclere@gmail.com,id-at-commonName=jfcpc,id-at-organizationalUnitName=Test Neuchatel,id-at-o…
▾ TLSv1.2 Record Layer: Handshake Protocol: Server Key Exchange
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 300
  ▾ Handshake Protocol: Server Key Exchange
```

HTTPd / Configuration / Basic

- httpd.conf:

```
Listen 8888

<VirtualHost _default_:8888>

SSLEngine on

SSLCertificateFile
"/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newcert.pem"

SSLCertificateKeyFile
"/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newkey.pem"

SSLCACertificateFile "/etc/pki/CA/cacert.pem"

SSLOptions  +StdEnvVars -ExportCertData

ScriptAlias /cgi-bin/ "/home/jfclere/APACHE/cgi-bin/"

</VirtualHost>
```

Client Certificate required

- httpd.conf:

```
Listen 8889
<VirtualHost _default_:8889>
SSLEngine on
SSLCertificateFile "/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newcert.pem"
SSLCertificateKeyFile "/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newkey.pem"
SSLCACertificateFile "/etc/pki/CA/cacert.pem"
SSLOptions  +StdEnvVars -ExportCertData
ScriptAlias /cgi-bin/ "/home/jfclere/APACHE/cgi-bin/"
SSLVerifyClient require
SSLVerifyDepth 1
</VirtualHost>
```

With revocation in a file.

- httpd.conf:

```
Listen 8890

<VirtualHost _default_:8890>

SSLEngine on

SSLCertificateFile "/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newcert.pem"

SSLCertificateKeyFile "/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newkey.pem"

SSLCACertificateFile "/etc/pki/CA/cacert.pem"

SSLOptions  +StdEnvVars -ExportCertData

ScriptAlias /cgi-bin/ "/home/jfclere/APACHE/cgi-bin/"

SSLVerifyClient require

SSLVerifyDepth 1

SSLCARevocationCheck leaf

SSLCARevocationFile  "/home/jfclere/NOTES/APACHECONNA2019/httpdssl/crl_01.pem

</VirtualHost>
```

With OCSP responder for revocation.

- httpd.conf:

```
Listen 8891

<VirtualHost _default_:8891>

SSLEngine on

SSLCertificateFile "/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newcert.pem"

SSLCertificateKeyFile "/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newkey.pem"

SSLCACertificateFile "/etc/pki/CA/cacert.pem"

SSLOptions  +StdEnvVars -ExportCertData

ScriptAlias /cgi-bin/ "/home/jfclere/APACHE/cgi-bin/"

SSLVerifyClient require

SSLVerifyDepth 1

SSLOCSPEnable on

SSLOCSPDefaultResponder http://jfcpc:2560/

SSLOCSPOverrideResponder on

</VirtualHost>
```

Using “OCSP responder” in certificate

- httpd.conf:

```
Listen 8892

<VirtualHost _default_:8892>

SSLEngine on

SSLCertificateFile "/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newcert.pem"

SSLCertificateKeyFile "/home/jfclere/NOTES/APACHECONNA2019/httpdssl/jfcpc_newkey.pem"

SSLCACertificateFile "/etc/pki/CA/cacert.pem"

SSLOptions  +StdEnvVars -ExportCertData

ScriptAlias /cgi-bin/ "/home/jfclere/APACHE/cgi-bin/"

SSLVerifyClient require

SSLVerifyDepth 1

SSLOCSPEnable on

</VirtualHost>
```

Servers!!!

- Let’s look to the server certificates:
  - **Validation like for the client certificates**
  - **Signed by CA**
  - **OCSP**
  - **stapling**

Let’s Encrypt!

- See Let's encrypt:
  - **Signed certificates valid for 90 days.**
  - **Challenge to prove you own the host/domain.**
    - **HTTP/DNS/~~TLS-SNI~~/TLS-ALPN**
  - **Renewal: certbot renew**
  - **Renewal: mod_md**
  - **OCSP stapling**

Certbot config

```
<VirtualHost _default_:443>

ServerName jfclere.noip.me:443

SSLEngine on

SSLCertificateFile /etc/letsencrypt/live/jfclere.noip.me/fullchain.pem

SSLCertificateKeyFile /etc/letsencrypt/live/jfclere.noip.me/privkey.pem

Include /etc/letsencrypt/options-ssl-apache.conf

</VirtualHost>
```

mod_md

```
<VirtualHost _default_:443>
ServerName jfclere.noip.me:443
SSLEngine on
</VirtualHost>
ServerAdmin jfclere@gmail.com
MDCertificateAgreement https://letsencrypt.org/documents/LE-SA-v1.2-November-15-2017.pdf
MDomain jfclere.noip.me
```

- **Note you have to restart the server the first time:**

  The Managed Domain jfclere.noip.me has been setup and changes will be activated on next (graceful) server restart.

- **SElinux: setsebool -P httpd_can_network_connect 1**

stapling

MDMustStaple (mod_md)

MDMustStaple On

SSLUseStapling (mod_ssl in ssl.conf)

SSLStaplingCache shmcb:/run/httpd/sslstapingcache(512000)

<VirtualHost _default_:443>

SSLUseStapling On

...

openssl s_client -connect jfclere.noip.me:443 -status

```
OCSP response:
======================================
OCSP Response Data:
    OCSP Response Status: successful (0x0)
    Response Type: Basic OCSP Response
    Version: 1 (0x0)
    Responder Id: C = US, O = Let's Encrypt, CN = Let's Encrypt Authority X3
    Produced At: Sep  3 14:28:00 2019 GMT
```

ACME V2

Not backward compatible with V1

Requires mod_md 2.x mod_md v2.1.5 (beta)

let's encrypt V2 services [Test for V2 clients.]

Soon in httpd

V1 will be sunset “ at some point in the future”.

Questions?
Thank you!

- jfclere@gmail.com
- users@httpd.apache.org
- dev@httpd.apache.org
- https://github.com/apache/httpd
- https://github.com/jfclere/AC2014scripts/blob/master/httpdssl.txt : commands for demos.

THANK YOU

Jean-Frederic Clere

@jfclere

jfclere@gmail.com