DANCE Protocols

IETF 113: DANCE Working Group
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Adopted and renamed documents

DANE TLS Client Authentication:

draft-ietf-dance-client-auth-00

TLS Extension for DANE Client Identity:

draft-ietf-dance-tls-clientid-00

Recent changes: tls-clientid, Section 3

A TLS server implementing this specification ~~MAY~~ **MUST** send an empty extension of type "dane_clientid" to indicate that it understands the extension and is capable of performing DANE client authentication. In TLS 1.2, the empty extension is sent in the ServerHello message. In TLS 1.3, it is sent in the CertificateRequest message.

A TLS client implementing this specification SHOULD send an extension of type "dane_clientid". If the client only needs to indicate that it has a DANE record and that the client's domain name identity can be obtained from its certificate, then the extension sent can be empty. If the client needs to send its domain name identity, then the "extension_data" field of the extension MUST contain a "ClientName" data structure populated with the domain name.

In TLS 1.2, the client extension is sent in the ClientHello message. In TLS 1.3, it is sent in the Certificate message. Additionally, **in TLS 1.3, the client is only permitted to send the extension if it sees the corresponding empty extension in the server's CertificateRequest message.**

to confirm to TLS 1.3 protocol requirements

RFC 8446 (TLS 1.3), Section 4.4.2

[...]

extensions: A set of extension values for the CertificateEntry. The "Extension" format is defined in Section 4.2. Valid extensions for server certificates at present include the OCSP Status extension [RFC6066] and the SignedCertificateTimestamp extension [RFC6962]; future extensions may be defined for this message as well. Extensions in the Certificate message from the server MUST correspond to ones from the ClientHello message. **Extensions in the Certificate message from the client MUST correspond to extensions in the CertificateRequest message from the server**. If an extension applies to the entire chain, it SHOULD be included in the first CertificateEntry.

```
     TLS CLIENT                                                    TLS SERVER
Key  ^ ClientHello
Exch | + key_share*
      | + psk_key_exchange_modes*
     v + pre_shared_key*              -------->
                                                           ServerHello  ^ Key
                                                          + key_share*  | Exch
                                                     + pre_shared_key*  v
                                                 {EncryptedExtensions}  ^  Server
                                                 {CertificateRequest    v  Params
                                                   *+DANE Client ID ext}
                                                        {Certificate*}   ^
                                                  {CertificateVerify*}   | Auth
                                                            {Finished}   v
                                      <--------    [Application Data*]
     ^ {Certificate
        +DANE Client ID ext]}
Auth | {CertificateVerify*}
     v {Finished}                     -------->


      [Application Data]              <------->     [Application Data]
```

no longer optional

dance-client-auth

Comment on list from Michael Richardson:

“I think that the introduction is very weak; I think that more references and integration with the to-be-adopted architecture document will solve that problem.

I suggest we write "IoT" rather than "IOT"

Discussion & next steps

- Protocol specification is largely done in our opinion. What’s missing or remains to be done?

- Working on the architecture doc and more detailed description of application use cases may inform other enhancements.
- As will implementation experience (see other talk today).

Additional Background Slides for Reference

(will not be presented)

Protocol Goal & History

- Goal: Authenticate client side of TLS connection with DANE
- History
    - Drafts originally developed in mid 2015
    - Target use cases: IOT device authentication & SMTP Transport security

Protocol Summary

- TLS Client has a DNS domain name identity
  - A public/private key pair & a certificate binding the public key to the domain name
  - Corresponding DANE TLSA record published in DNS

- TLS server
  - Sends Certificate Request message in handshake; extracts client identity from presented certificate, constructs TLSA query, validates DANE TLSA response with DNSSEC

Protocol Summary

- New TLS extension for conveying client’s DANE identity to the server
  - For signaling support for DANE TLS client authentication (empty extension if signal only)
  - For conveying client DNS identity when used with TLS raw public key auth (RFC 7250)
  - In TLS 1.3, this extension is carried in the (encrypted) Client Certificate message.
  - In TLS 1.2 it is carried in the first client Client Hello extension, and thus has no provision for privacy protection.
  - (Optionally, the server can also send an empty extension to signal that it supports this capability. TLS 1.3: Certificate Request message, TLS 1.2: Server Hello extension)

Client DNS Naming Convention

Draft is not proscriptive, but proposes 2 naming formats that may be generally suitable for many types of applications.

Format 1: Service specific client identity

```
_service.[client-domain-name]
```

e.g.

```
_smtp-client.relay1.example.com
```

1st label identifies the application service name. The remaining labels are composed of the client domain name. Allows the same client to have distinct authentication credentials for distinct application services.

Client DNS Naming Convention

Format 2: (IOT?) Device Identity

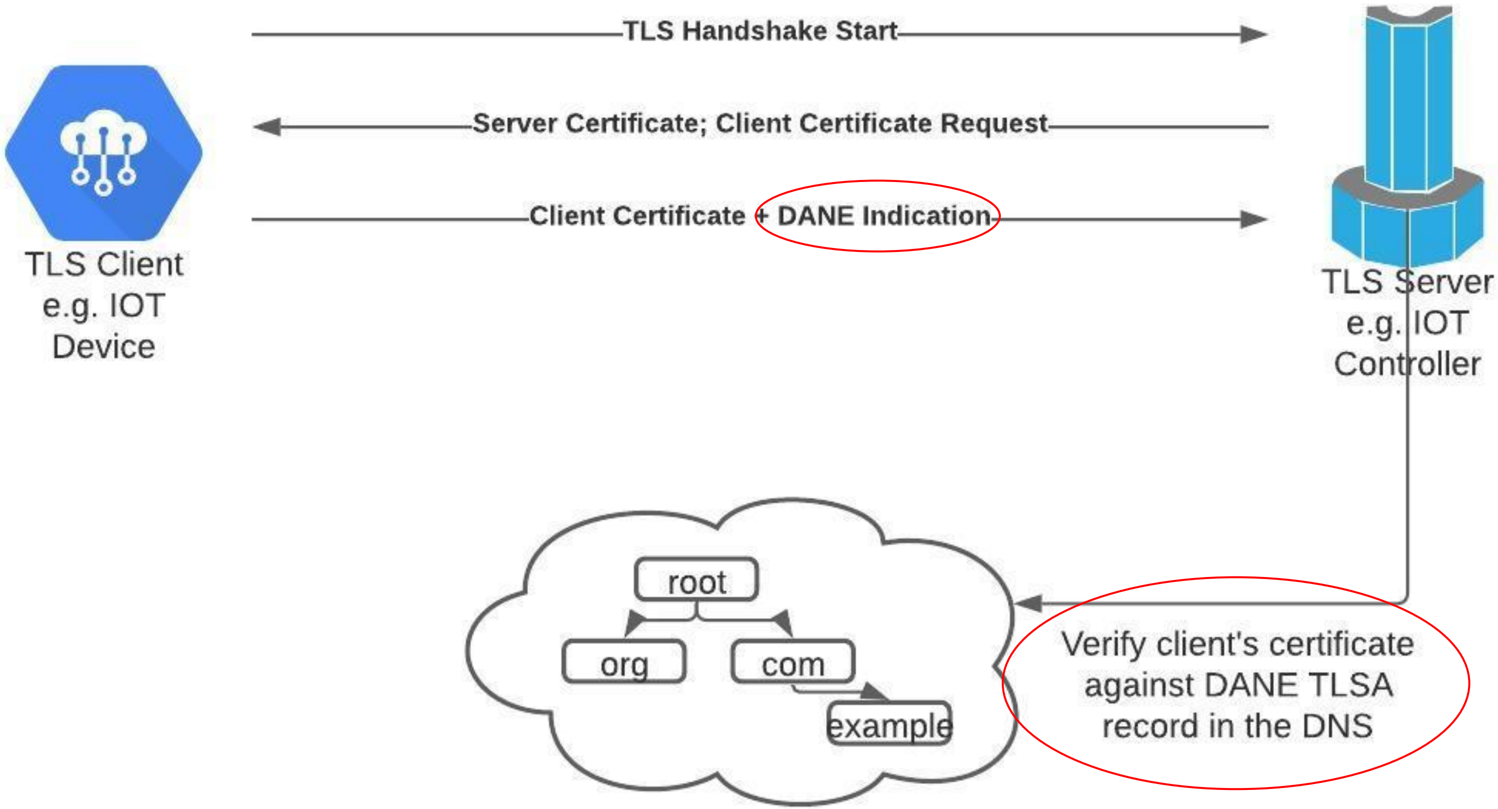
[deviceid]._device.[org-domain-name]

e.g.

a1b2c3._device.subdomain.example.net.

- “a1b2c3”: device identifier (could be multiple left most labels)
- _device: identity grouping label
- subdomain: organizational label(s) (optional)
- example.net: organizational domain

```
sensor7._device.example.com. IN TLSA (
          3 1 2
          0f8b48ff5fd94117f21b6550aaee89c8
          d8adbc3f433c8e587a85a14e54667b25
          f4dcd8c4ae6162121ea9166984831b57
          b408534451fd1b9702f8de0532ecd03c )
```



TLS Handshake Start

Server Certificate; Client Certificate Request

Client Certificate + DANE Indication

TLS Client
e.g. IOT
Device

TLS Server
e.g. IOT
Controller

Verify client's certificate
against DANE TLSA
record in the DNS

Protocol annotation for TLS 1.3

```
     TLS CLIENT                                             TLS SERVER
Key  ^ ClientHello
Exch | + key_share*
     | + psk_key_exchange_modes*
     v + pre_shared_key*               -------->
                                                           ServerHello  ^ Key
                                                          + key_share*  | Exch
                                                     + pre_shared_key*  v
                                                 {EncryptedExtensions}  ^  Server
                                                 {CertificateRequest}   v  Params

                                                        {Certificate*}   ^
                                                  {CertificateVerify*}   | Auth
                                                            {Finished}   v
                                      <--------    [Application Data*]
     ^ {Certificate}

Auth | {CertificateVerify*}
     v {Finished}                     -------->




     [Application Data]               <-------->    [Application Data]
     TLS CLIENT                                            TLS SERVER
Key  ^ ClientHello
Exch | + key_share*
     | + psk_key_exchange_modes*
     v + pre_shared_key*              -------->
                                                          ServerHello  ^ Key
                                                         + key_share*  | Exch
                                                     + pre_shared_key*  v
                                                 {EncryptedExtensions}  ^  Server
                                                 {CertificateRequest    v  Params
                                                   *+DANE Client ID ext}
                                                        {Certificate*}  ^
                                                  {CertificateVerify*}  | Auth
                                                            {Finished}  v
                                      <--------    [Application Data*]
     ^ {Certificate}

Auth | {CertificateVerify*}
     v {Finished}                     -------->


      [Application Data]              <------->     [Application Data]
```

Capability
advertisement
via empty extension.

```
     TLS CLIENT                                             TLS SERVER
Key  ^ ClientHello
Exch | + key_share*
     | + psk_key_exchange_modes*
     v + pre_shared_key*              -------->
                                                           ServerHello  ^ Key
                                                          + key_share*  | Exch
                                                     + pre_shared_key*  v
                                                 {EncryptedExtensions}  ^  Server
                                                 {CertificateRequest    v  Params
                                                   *+DANE Client ID ext}
                                                        {Certificate*}  ^
                                                  {CertificateVerify*}  | Auth
                                                            {Finished}  v
                                      <--------    [Application Data*]
     ^ {Certificate
        +DANE Client ID ext]}
Auth | {CertificateVerify*}
     v {Finished}                     -------->

      [Application Data]              <-------->    [Application Data]
```

Empty extension: convey intent to be authenticated via DANE. For raw pubkey authentication, convey client’s full domain name.

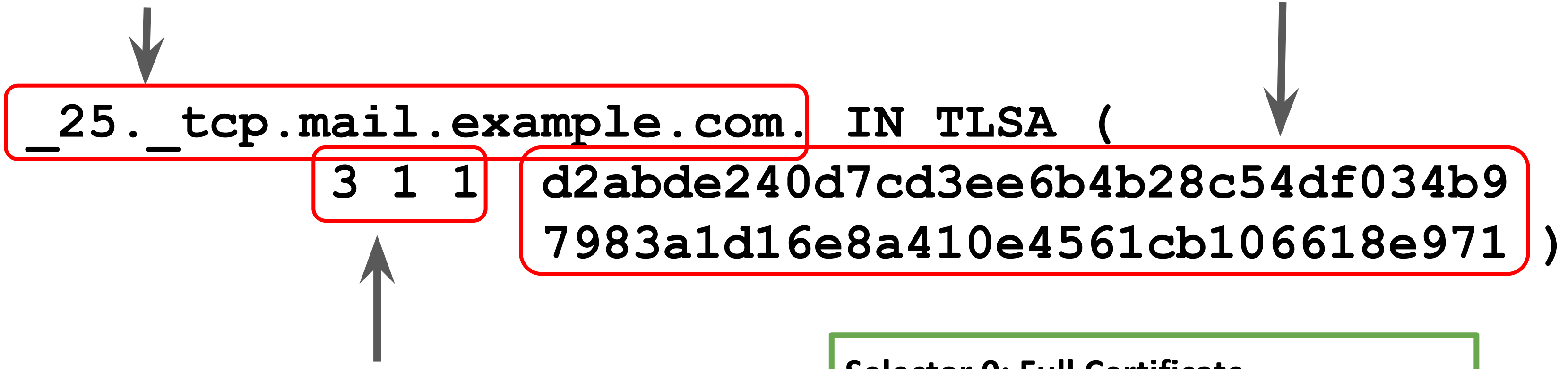
```
     TLS CLIENT                                              TLS SERVER
Key  ^ ClientHello
Exch | + key_share*
     | + psk_key_exchange_modes*
     v + pre_shared_key*           -------->
                                                    ServerHello  ^ Key
                                                   + key_share*  | Exch
                                              + pre_shared_key*  v
                                          {EncryptedExtensions}  ^  Server
                                          {CertificateRequest    v  Params
                                            *+DANE Client ID ext}
                                                 {Certificate*}  ^
                                           {CertificateVerify*}  | Auth
                                                     {Finished}  v
                                   <--------    [Application Data*]
     ^ {Certificate
        +DANE Client ID ext]}
Auth | {CertificateVerify*}
     v {Finished}                  -------->
                                          [Verify Client w/ DANE]
                                          [TLS alert on failure ]

      [Application Data]           <------->     [Application Data]
```

Extract client's identity, lookup TLSA RRset and authenticate the client's cert or pubkey.

1-Slide DANE Primer

port, protocol, domain name

data (hex encoded) associated with the certificate or public key



```
_25._tcp.mail.example.com. IN TLSA (
                   3 1 1  d2abde240d7cd3ee6b4b28c54df034b9
                          7983a1d16e8a410e4561cb106618e971 )
```

Parameters: Usage, Selector, Matching-Type

Selector 0: Full Certificate
Selector 1: Public Key (could be raw)

Usage 0: PKIX-CA: CA Constraint
Usage 1: PKIX-EE: Service Cert Constraint
Usage 2: DANE-TA: Trust Anchor Assertion
Usage 3: DANE-EE: Domain Issued Certificate

Matching-Type 0: Full Content
Matching-Type 1: SHA-256 Hash
Matching-Type 2: SHA-512 Hash

DANE record in this example specifies the SHA256 hash of the subject public key of the certificate that should match the End-Entity certificate. Authenticated entirely in the DNS.