draft-friel-tls-over-http-00 Application Layer ATLS

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Related drafts

- draft-tschofenig-layered-tls-00
  - Layered DTLS/TLS

- draft-ietf-anima-bootstrapping-keyinfra-09
  - Bootstrapping Remote Secure Key Infrastructures (BRSKI)

Motivation – Device Bootstrap

- Installer unboxes and powers up a device that needs to establish a secure connection to a cloud service
- There is a TLS Terminating middlebox between the device and the cloud
- The device cannot do TLS certificate validation as it does not yet trust the private CA root used by the middlebox
- The device fails to connect to the cloud service

Potential Solutions

- Address via explicit, expensive configuration by operator or vendor
  1. Operator-specific configuration installed on device prior to shipping to customer – expensive and limited applicability
  2. Operator disables TLS interception on middlebox for specific domains – does not meet customer InfoSec requirements
  3. Operator manually installs private root on device – expensive and time consuming
- Device logic to work around infrastructure restrictions
  4. **Device establishes an application layer encrypted channel with cloud service**
     - Device could simply download middlebox trust information using this channel and then switch to network TLS

Application layer encrypted channel options

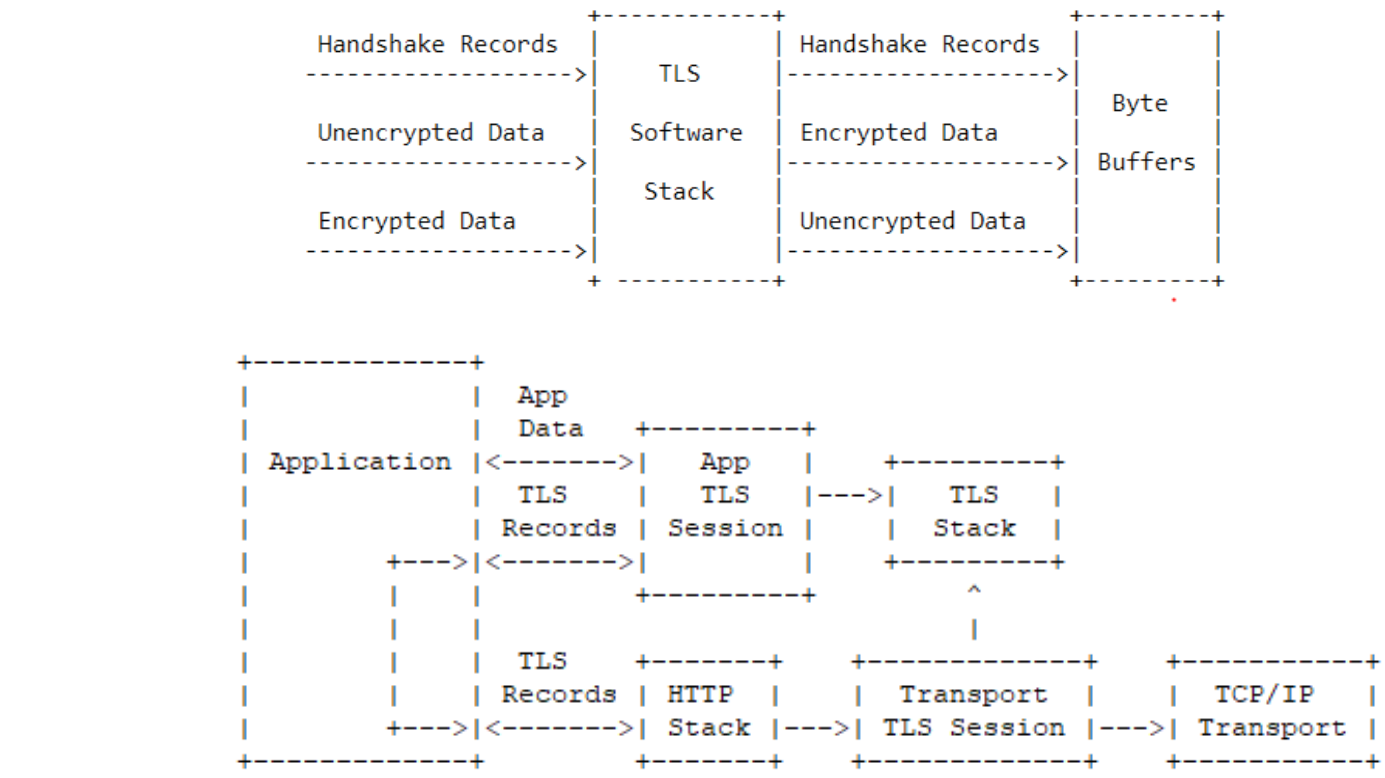
- Multiple potential solutions including but not limited to
  1. Define a handshake using JOSE/JWE/JWT
  2. Define an encapsulation for Noise
  3. **Reuse TLS stack and exchange TLS Records**

- Design goal: do this with as few lines of code as possible and minimise library dependencies
- Proposal rationale: device already calls TLS stack APIs at network layer, just get the device to call the APIs twice.

Transporting TLS in HTTP

- Transport (flights of) TLS Records in HTTP message bodies
- Lowest common denominator and greatest chance of traversing middleboxes
- ATLS server addressed with HTTPS URI vs. host/port
  - Could host application directly
  - Or do something more elaborate, like an HTTP reverse proxy
- Top-level applications suited to things that “look like” HTTP
  - Could alternatively run over a websocket

Architecture



Working proof-of-concept:

- OpenSSL C client talking ATLS over HTTPS to
- Java JSSE Spring Web Server
- Easy to consume OpenSSL and JSSE APIs summarised in draft Appendix

Discussion Points

- Turtles all the way down
  - Will middleboxes block encrypted application layer data?
  - Generally applicable for any application layer crypto: JOSE/JWE, Noise, etc.
- Use ATLS just for handshake or for application data too
  - Could just use ATLS for 2xRTTs and then use RFC5705 (Keying Material Exporters) and switch to RFC8188 (Encrypted Content-Encoding)
- HTTP Transport Reliability
  - Transport DTLS records in HTTP bodies
  - Just using ATLS for handshake 2xRTTs also mitigates somewhat
- Why not use HTTP CONNECT tunnels?
  - HTTP CONNECT and TLS Intercept are logically different functions
  - HTTP CONNECT tunnel establishment could succeed but there could still be a TLS middlebox behind the HTTP Proxy in the local network
- Server -> Client signalling
  - Upgrade to a websocket if necessary