

Workgroup: UTA  
Internet-Draft:  
draft-tschofenig-uta-tls13-profile-04  
Updates: [7925](#) (if approved)  
Published: 22 April 2020  
Intended Status: Standards Track  
Expires: 24 October 2020  
Authors: H. Tschofenig    T. Fossati  
          Arm Limited        Arm Limited

## **TLS/DTLS 1.3 Profiles for the Internet of Things**

### **Abstract**

This document is a companion to RFC 7925 and defines TLS/DTLS 1.3 profiles for Internet of Things devices. It also updates RFC 7925 with regards to the X.509 certificate profile.

### **Status of This Memo**

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on 24 October 2020.

### **Copyright Notice**

Copyright (c) 2020 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

## Table of Contents

- [1. Introduction](#)
  - [1.1. Conventions and Terminology](#)
- [2. Credential Types](#)
- [3. Error Handling](#)
- [4. Session Resumption](#)
- [5. Compression](#)
- [6. Perfect Forward Secrecy](#)
- [7. Keep-Alive](#)
- [8. Timeouts](#)
- [9. Random Number Generation](#)
- [10. Server Name Indication \(SNI\)](#)
- [11. Maximum Fragment Length Negotiation](#)
- [12. Crypto Agility](#)
- [13. Key Length Recommendations](#)
- [14. 0-RTT Data](#)
- [15. Certificate Profile](#)
  - [15.1. Compression](#)
- [16. Security Considerations](#)
- [17. IANA Considerations](#)
- [18. References](#)
  - [18.1. Normative References](#)
  - [18.2. Informative References](#)
- [Authors' Addresses](#)

## 1. Introduction

This document defines a profile of DTLS 1.3 [[I-D.ietf-tls-dtls13](#)] and TLS 1.3 [[RFC8446](#)] that offers communication security services for IoT applications and is reasonably implementable on many constrained devices. Profile thereby means that available configuration options and protocol extensions are utilized to best support the IoT environment.

For IoT profiles using TLS/DTLS 1.2 please consult [[RFC7925](#)]. This document re-uses the communication pattern defined in [[RFC7925](#)] and makes IoT-domain specific recommendations for version 1.3 (where necessary).

TLS 1.3 has been re-designed and several previously defined extensions are not applicable to the new version of TLS/DTLS anymore. This clean-up also simplifies this document. Furthermore, many outdated ciphersuites have been omitted from the TLS/DTLS 1.3 specification.

### 1.1. Conventions and Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

## 2. Credential Types

In accordance with the recommendations in [[RFC7925](#)], a compliant implementation MUST implement TLS\_AES\_128\_GCM\_SHA256. It SHOULD implement TLS\_CHACHA20\_POLY1305\_SHA256.

Pre-shared key based authentication is integrated into the main TLS/DTLS 1.3 specification and has been harmonized with session resumption.

A compliant implementation supporting authentication based on certificates and raw public keys MUST support digital signatures with ecdsa\_secp256r1\_sha256. A compliant implementation MUST support the key exchange with secp256r1 (NIST P-256) and SHOULD support key exchange with X25519.

A plain PSK-based TLS/DTLS client or server MUST implement the following extensions:

- \*supported\_versions

- \*cookie

\*server\_name

\*pre\_shared\_key

\*psk\_key\_exchange\_modes

For TLS/DTLS clients and servers implementing raw public keys and/or certificates the guidance for mandatory-to-implement extensions described in Section 9.2 of [[RFC8446](#)] MUST be followed.

### **3. Error Handling**

TLS 1.3 simplified the Alert protocol but the underlying challenge in an embedded context remains unchanged, namely what should an IoT device do when it encounters an error situation. The classical approach used in a desktop environment where the user is prompted is often not applicable with unattended devices. Hence, it is more important for a developer to find out from which error cases a device can recover from.

### **4. Session Resumption**

TLS 1.3 has built-in support for session resumption by utilizing PSK-based credentials established in an earlier exchange.

### **5. Compression**

TLS 1.3 does not have support for compression.

### **6. Perfect Forward Secrecy**

TLS 1.3 allows the use of PFS with all ciphersuites since the support for it is negotiated independently.

### **7. Keep-Alive**

The discussion in Section 10 of [[RFC7925](#)] is applicable.

### **8. Timeouts**

The recommendation in Section 11 of [[RFC7925](#)] is applicable. In particular this document RECOMMENDED to use an initial timer value of 9 seconds with exponential back off up to no less than 60 seconds.

Question: DTLS 1.3 now offers per-record retransmission and therefore introduces much less congestion risk associated with spurious retransmissions. Hence, should we relax the 9s initial timeout?

## 9. Random Number Generation

The discussion in Section 12 of [\[RFC7925\]](#) is applicable with one exception: the ClientHello and the ServerHello messages in TLS 1.3 do not contain `gmt_unix_time` component anymore.

## 10. Server Name Indication (SNI)

This specification mandates the implementation of the SNI extension. Where privacy requirements require it, the encrypted SNI extension [\[I-D.ietf-tls-esni\]](#) prevents an on-path attacker to determine the domain name the client is trying to connect to. Note, however, that the extension is still at an experimental state.

## 11. Maximum Fragment Length Negotiation

The Maximum Fragment Length Negotiation (MFL) extension has been superseded by the Record Size Limit (RSL) extension [\[RFC8449\]](#). Implementations in compliance with this specification MUST implement the RSL extension and SHOULD use it to indicate their RAM limitations.

## 12. Crypto Agility

The recommendations in Section 19 of [\[RFC7925\]](#) are applicable.

## 13. Key Length Recommendations

The recommendations in Section 20 of [\[RFC7925\]](#) are applicable.

## 14. 0-RTT Data

When clients and servers share a PSK, TLS/DTLS 1.3 allows clients to send data on the first flight ("early data"). This features reduces communication setup latency but requires application layer protocols to define its use with the 0-RTT data functionality.

For HTTP this functionality is described in [\[RFC8470\]](#). This document specifies the application profile for CoAP, which follows the design of [\[RFC8470\]](#).

For a given request, the level of tolerance to replay risk is specific to the resource it operates upon (and therefore only known to the origin server). In general, if processing a request does not have state-changing side effects, the consequences of replay are not significant. The server can choose whether it will process early data before the TLS handshake completes.

It is RECOMMENDED that origin servers allow resources to explicitly configure whether early data is appropriate in requests.

This specification specifies the Early-Data option, which indicates that the request has been conveyed in early data and that a client understands the 4.25 (Too Early) status code. The semantic follows [\[RFC8470\]](#).

No.	C	U	N	R	Name	Format	Length	Default	E
TBD	x				Early-Data	empty	0	(none)	x

C=Critical. U=Unsafe. N=NoCacheKey. R=Repeatable.  
E=Encrypt and Integrity Protect (when using OSCORE)

Figure 1: Early-Data Option

## 15. Certificate Profile

This section is intended for discussing updates to the certificate profile defined in [\[RFC7925\]](#). Initial set of things to consider:

\*pathLenConstraint

Question: should also we move the ASN.1 schema from Appendix B of [\[I-D.raza-ace-cbor-certificates\]](#) here and let it have it by reference?

### 15.1. Compression

The compression methods defined in [\[I-D.ietf-tls-certificate-compression\]](#) do not seem to deal effectively with [\[RFC7925\]](#) profiled certificates: zlib compresses the example cert by 9%, but other certificates and compression algorithms do in many cases increase the overall size. On the other hand, [\[I-D.raza-ace-cbor-certificates\]](#) provides a more efficient scheme, yielding to compression rates higher than 50% (see Section 3 of [\[I-D.mattsson-cose-cbor-cert-compress\]](#)).

Question: should we RECOMMEND CBOR compression? How is that negotiated?

## 16. Security Considerations

This entire document is about security.

## 17. IANA Considerations

IANA is asked to add the Option defined in [Figure 2](#) to the CoAP Option Numbers registry.

Number	Name	Reference
TBD	Early-Data	RFCThis

Figure 2: Early-Data Option

IANA is asked to add the Response Code defined in [Figure 3](#) to the CoAP Response Code registry.

Code	Description	Reference
4.25	Too Early	RFCThis

Figure 3: Too Early Response Code

## 18. References

### 18.1. Normative References

- [I-D.ietf-tls-dtls13] Rescorla, E., Tschofenig, H., and N. Modadugu, "The Datagram Transport Layer Security (DTLS) Protocol Version 1.3", Work in Progress, Internet-Draft, draft-ietf-tls-dtls13-37, 9 March 2020, <<http://www.ietf.org/internet-drafts/draft-ietf-tls-dtls13-37.txt>>.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- [RFC7925] Tschofenig, H., Ed. and T. Fossati, "Transport Layer Security (TLS) / Datagram Transport Layer Security (DTLS) Profiles for the Internet of Things", RFC 7925, DOI 10.17487/RFC7925, July 2016, <<https://www.rfc-editor.org/info/rfc7925>>.
- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.
- [RFC8446] Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.3", RFC 8446, DOI 10.17487/RFC8446, August 2018, <<https://www.rfc-editor.org/info/rfc8446>>.

**[RFC8449]**

Thomson, M., "Record Size Limit Extension for TLS", RFC 8449, DOI 10.17487/RFC8449, August 2018, <<https://www.rfc-editor.org/info/rfc8449>>.

**[RFC8470]**

Thomson, M., Nottingham, M., and W. Tareau, "Using Early Data in HTTP", RFC 8470, DOI 10.17487/RFC8470, September 2018, <<https://www.rfc-editor.org/info/rfc8470>>.

## **18.2. Informative References**

**[I-D.ietf-tls-certificate-compression]**

Ghedini, A. and V. Vasiliev, "TLS Certificate Compression", Work in Progress, Internet-Draft, draft-ietf-tls-certificate-compression-10, 6 January 2020, <<http://www.ietf.org/internet-drafts/draft-ietf-tls-certificate-compression-10.txt>>.

**[I-D.ietf-tls-esni]**

Rescorla, E., Oku, K., Sullivan, N., and C. Wood, "Encrypted Server Name Indication for TLS 1.3", Work in Progress, Internet-Draft, draft-ietf-tls-esni-06, 9 March 2020, <<http://www.ietf.org/internet-drafts/draft-ietf-tls-esni-06.txt>>.

**[I-D.mattsson-cose-cbor-cert-compress]**

Mattsson, J., Selander, G., Raza, S., Hoglund, J., and M. Furuheid, "CBOR Object Signing and Encryption (COSE): Headers for Carrying CBOR Compressed Certificates", Work in Progress, Internet-Draft, draft-mattsson-cose-cbor-cert-compress-00, 9 March 2020, <<http://www.ietf.org/internet-drafts/draft-mattsson-cose-cbor-cert-compress-00.txt>>.

**[I-D.raza-ace-cbor-certificates]**

Raza, S., Hoglund, J., Selander, G., Mattsson, J., and M. Furuheid, "CBOR Profile of X.509 Certificates", Work in Progress, Internet-Draft, draft-raza-ace-cbor-certificates-04, 9 March 2020, <<http://www.ietf.org/internet-drafts/draft-raza-ace-cbor-certificates-04.txt>>.

## **Authors' Addresses**

Hannes Tschofenig  
Arm Limited

Email: [Hannes.Tschofenig@gmx.net](mailto:Hannes.Tschofenig@gmx.net)

Thomas Fossati  
Arm Limited



Email: [Thomas.Fossati@arm.com](mailto:Thomas.Fossati@arm.com)