Using CBOR Web Tokens (CWTs) in Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)
draft-tschofenig-tls-cwt-02

Abstract

The TLS protocol supports different credentials, including pre-shared keys, raw public keys, and X.509 certificates. For use with public key cryptography developers have to decide between raw public keys, which require out-of-band agreement and full-fledged X.509 certificates. For devices where the reduction of code size is important it is desirable to minimize the use of X.509-related libraries. With the CBOR Web Token (CWT) a structure has been defined that allows CBOR-encoded claims to be protected with CBOR Object Signing and Encryption (COSE).

This document registers a new value to the "TLS Certificate Types" sub-registry to allow TLS and DTLS to use CWTs. Conceptually, CWTs can be seen as a certificate format (when with public key cryptography) or a Kerberos ticket (when used with symmetric key cryptography).

Status of This Memo

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

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This Internet-Draft will expire on January 14, 2021.
1. Introduction

The CBOR Web Token (CWT) [RFC8392] was defined as the CBOR-based version of the JSON Web Token (JWT) [RFC7519]. JWT is used extensively on Web applications and for use with Internet of Things environments the belief is that a more lightweight encoding, namely CBOR, is needed. CWTs, like JWTs, contain claims and those claims are protected against modifications using COSE [RFC8152]. CWTs are flexible with regard to the use of cryptography and hence CWTs may be protected using a keyed message digest, or a digital signature. One of the claims allows keys to be included, as described in [I-D.ietf-ace-cwt-proof-of-possession]. This specification makes use of these proof-of-possession claims in CWTs. This document mandates a minimum number of claims to be present in a CWT. There may, however, be a number of additional claims present in a CWT. An example of a token with a larger number of claims is the Entity Attestation Token (EAT), which may also be encoded as a CWT.

Fundamentally, there are two types of keys that can be used with CWTs:

- Asymmetric keys: In this case a CWT contains a COSE_Key [RFC8152] representing an asymmetric public key. To protect the CWT against modifications the CWT also needs to be digitally signed.

- Symmetric keys: In this case a CWT contains the Encrypted_COSE_Key [RFC8152] structure representing a symmetric key encrypted to a key known to the recipient using COSE_Encrypt or COSE_Encrypt0. Again, to protect the CWT against modifications a keyed message digest is used.

The CWT also allows mixing symmetric and asymmetric crypto although this is less likely to be used in practice.

Exchanging CWTs in the TLS / DTLS handshake offers an alternative to the use of raw public keys and X.509 certificates. Compared to raw public keys, CWTs allow more information to be included via the use of claims. Compared to X.509 certificates CBOR offers an alternative encoding format, which may also be used by the application layer thereby potentially reducing the overall code size requirements.
2. 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 RFC 2119 [RFC2119].

3. The CWT Certificate Type

This document defines a new value to the "TLS Certificate Types" sub-registry and the value is defined as follows.

```c
/* Managed by IANA */
enum {
    X509(0),
    RawPublicKey(2),
    CWT(TBD),
    (255)
} CertificateType;

struct {
    select (certificate_type) {
        /"CWT "certificate type" defined in this document.*/
        case CWT:
            opaque cwt_data<1..2^24-1>;
        
        /"RawPublicKey defined in RFC 7250"*/
        case RawPublicKey:
            opaque ASN.1_subjectPublicKeyInfo<1..2^24-1>;
        
        /"X.509 certificate defined in RFC 5246"*/
        case X.509:
            opaque cert_data<1..2^24-1>;
    }
    Extension extensions<0..2^16-1>;
} CertificateEntry;
```

4. Representation and Verification the Identity of Application Services
RFC 6125 [RFC6125] provides guidance for matching identifiers used in X.509 certificates against a reference identifier, i.e. an identifier constructed from a source domain and optionally an application service type. Different types of identifiers have been defined over time, such as CN-IDs, DNS-IDs, SRV-IDs, and URI-IDs, and they may be carried in different fields inside the X.509 certificate, such as in the Common Name or in the subjectAltName extension.

For CWTs issued to servers the following rule applies: To claim conformance with this specification an implementation MUST populate the Subject claim with the value of the Server Name Indication (SNI) extension. The Subject claim is of type StringOrURI. If it is string an equality match is used between the Subject claim value and the SNI. If the value contains a URI then the URI schema must be matched against the service being requested and the remaining part of the URI is matched against the SNI in an equality match (since the SNI only defines Hostname types).

For CWTs issued to clients the application service interacting with the TLS/DTLS stack on the server side is responsible for authenticating the client. No specific rules apply but the Subject and the Audience claims are likely to be good candidates for authorization policy checks.

Note: Verification of the Not Before and the Expiration Time claims MUST be performed to determine the validity of the received CWT.

5. Security and Privacy Considerations

The security and privacy characteristics of this extension are best described in relationship to certificates (when asymmetric keys are used) and to Kerberos tickets (when symmetric keys are used) since the main difference is in the encoding.

When creating proof-of-possession keys the recommendations for state-of-the-art key sizes and algorithms have to be followed. For TLS/DTLS those algorithm recommendations can be found in [RFC7925] and [RFC7525].

CWTs without proof-of-possession keys MUST NOT be used.
When CWTs are used with TLS 1.3 [RFC8446] and DTLS 1.3 [I-D.ietf-tls-dtls13] additional privacy properties are provided since most handshake messages are encrypted.

6. IANA Considerations

IANA is requested to add a new value to the "TLS Certificate Types" sub-registry for CWTs.

7. References

7.1. Normative References

[I-D.ietf-ace-cwt-proof-of-possession]

[I-D.ietf-tls-dtls13]


7.2. Informative References


7.3. URIs

[1] mailto:tls@ietf.org


Appendix A. History
Appendix B. Working Group Information

The discussion list for the IETF TLS working group is located at the e-mail address tls@ietf.org [1]. Information on the group and information on how to subscribe to the list is at https://www1.ietf.org/mailman/listinfo/tls [2]

Archives of the list can be found at: https://www.ietf.org/mail-archive/web/tls/current/index.html [3]

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