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C. Bormann
Universitaet Bremen TZI
B. Gamari
Well-Typed
H. Birkholz
Fraunhofer SIT
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Concise Binary Object Representation (CBOR) Tags for Time, Duration, and
Period
[draft-bormann-cbor-time-tag-01](#)

Abstract

The Concise Binary Object Representation (CBOR, [RFC 7049](#)) is a data format whose design goals include the possibility of extremely small code size, fairly small message size, and extensibility without the need for version negotiation.

In CBOR, one point of extensibility is the definition of CBOR tags. [RFC 7049](#) defines two tags for time: CBOR tag 0 ([RFC3339](#) time) and tag 1 (Posix time [[TIME T](#)], int or float). Since then, additional requirements have become known. The present document defines a CBOR tag for time that allows a more elaborate representation of time, and anticipates the definition of related CBOR tags for duration and time period. It is intended as the reference document for the IANA registration of the CBOR tags defined.

Note to Readers

Version -00 of the present draft opened up the possibilities provided by extended representations of time in CBOR. The present version -01 consolidates this draft to non-speculative content, the normative parts of which are believed will stay unchanged during further development of the draft. This version is provided to aid the registration of the CBOR tag immediately needed. Further versions will re-introduce some of the material from -00, but in a more concrete form.

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Internet-Draft

CBOR tag for extended time

June 2017

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Table of Contents

1.	Introduction	3
1.1.	Terminology	3
1.2.	Background	3
2.	Objectives	3
3.	Time Format	4
3.1.	Key 1	5
3.2.	Keys 4 and 5	5
3.3.	Keys -3, -6, -9, -12, -15, -18	5
4.	CDDL typenames	5
5.	IANA Considerations	6
6.	Security Considerations	6
7.	References	7
7.1.	Normative References	7
7.2.	Informative References	8
	Acknowledgements	8
	Authors' Addresses	8

1. Introduction

The Concise Binary Object Representation (CBOR, [[RFC7049](#)]) provides for the interchange of structured data without a requirement for a pre-agreed schema. [RFC 7049](#) defines a basic set of data types, as well as a tagging mechanism that enables extending the set of data types supported via an IANA registry.

(TBD: Expand on text from abstract here.)

1.1. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

The term "byte" is used in its now customary sense as a synonym for "octet". Where bit arithmetic is explained, this document uses the notation familiar from the programming language C (including C++14's `0bnnn` binary literals), except that the operator `**` stands for exponentiation.

1.2. Background

Additional information about the complexities of time representation can be found in [[TIME](#)]. This specification uses a number of terms that should be familiar to connoisseurs of precise time; references for these may need to be added.

2. Objectives

For the time tag, the present specification addresses the following objectives that go beyond the original tags 0 and 1:

- o Additional resolution for epoch-based time (as in tag 1). CBOR tag 1 only provides for integer and up to binary64 floating point

representation of times, limiting resolution to approximately microseconds at the time of writing (and progressively becoming worse over time).

Not currently addressed, but possibly covered by the definition of additional map keys for the map inside the tag:

- o Indication of time scale. Tags 0 and 1 are for UTC; however, some interchanges are better performed on TAI. Other time scales may be registered once they become relevant (e.g., one of the proposed successors to UTC that might no longer use leap seconds, or a scale based on smeared leap seconds).

- o Direct representation of natural platform time formats. Some platforms use epoch-based time formats that require some computation to convert them into the representations allowed by tag 1; these computations can also lose precision and cause ambiguities. (TBD: The present specification does not take a position on whether tag 1 can be "fixed" to include, e.g., Decimal or BigFloat representations. It does define how to use these with the extended time format.)
- o Additional indication of intents about the interpretation of the time given, in particular for future times. Intents might include information about time zones, daylight savings times, etc.

Additional tags might later be defined for duration and period. The objectives for such duration and period tags are likely similar.

[3.](#) Time Format

An extended time is indicated by CBOR tag TBDET, which tags a map data item (CBOR major type 5). The map may contain integer (major types 0 and 1) or text string (major type 3) keys, with the value type determined by each specific key. Implementations MUST ignore key/value types they do not understand for negative integer and text string values of the key. Not understanding key/value for unsigned keys is an error.

The map must contain exactly one unsigned integer key, which specifies the "base time", and may also contain one or more negative integer or text-string keys, which may encode supplementary

information such as:

- o a higher precision time offset to be added to the base time,

Future keys may add:

- o a reference time scale and epoch different from the default UTC and 1970-01-01
- o information about clock source and precision, accuracy, and resolution
- o intent information such as timezone and daylight savings time, and/or possibly positioning coordinates, to express information that would indicate a local time.

While this document does not define supplementary text keys, a number of unsigned and negative-integer keys are defined below.

[3.1.](#) Key 1

Key 1 indicates a value that is exactly like the data item that would be tagged by CBOR tag 1 (Posix time [[TIME_T](#)] as int or float).

[3.2.](#) Keys 4 and 5

Keys 4 and 5 are like key 1, except that the data item is an array as defined for CBOR tag 4 or 5, respectively. This can be used to include a Decimal or Bigfloat epoch-based float [[TIME_T](#)] in an extended time.

[3.3.](#) Keys -3, -6, -9, -12, -15, -18

The keys -3, -6, -9, -12, -15 and -18 indicate additional decimal fractions by giving an unsigned integer (major type 0) and scaling this with the scale factor 1e-3, 1e-6, 1e-9, 1e-12, 1e-15, and 1e-18, respectively (see Table 1). More than one of these keys MUST NOT be present in one extended time data item. These additional fractions are added to a base time in seconds [[SI-SECOND](#)] indicated by a Key 1, which then MUST also be present and MUST have an integer value.

Key	meaning	example usage
-3	milliseconds	Java time
-6	microseconds	(old) UNIX time
-9	nanoseconds	(new) UNIX time
-12	picoseconds	Haskell time
-15	femtoseconds	(future)
-18	attoseconds	(future)

Table 1: Key for decimally scaled Fractions

4. CDDL typenames

For the use with the CBOR Data Definition Language, CDDL [[I-D.greevenbosch-appsawg-cbor-cddl](#)], the type names defined in Figure 1 are recommended:

```
etime = #6.TBDET({* (int/tstr) => any})
```

Figure 1: Recommended type names for CDDL

5. IANA Considerations

IANA is requested to allocate the tags in Table 2 from the FCFS space, with the present document as the specification reference.

Tag	Data Item	Semantics
TBDET	map	[RFCthis] extended time
TBDED	map	[RFCthis] duration
TBDEP	map	[RFCthis] period

Table 2: Values for Tags

Although duration and period are not yet defined in the present version of this document, the tag values for duration and period are requested at the same time as the value for extended time in order to achieve allocation of all three values as a contiguous set.

RFC editor note: Please replace TBDET, TBDED, and TBDEP by the tag number allocated by IANA throughout the document and delete this note.

6. Security Considerations

The security considerations of [RFC 7049](#) apply; the tags introduced here are not expected to raise security considerations beyond those.

Time, of course, has significant security considerations; these include the exploitation of ambiguities where time is security relevant (e.g., for freshness or in a validity span) or the disclosure of characteristics of the emitting system (e.g., time zone, or clock resolution and wall clock offset).

7. References

7.1. Normative References

[I-D.greevenbosch-appsawg-cbor-cddl]

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Bormann, et al.

Expires December 16, 2017

[Page 7]

Internet-Draft

CBOR tag for extended time

June 2017

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Acknowledgements

Authors' Addresses

Carsten Bormann
Universitaet Bremen TZI
Postfach 330440
Bremen D-28359
Germany

Phone: +49-421-218-63921
Email: cabo@tzi.org

Ben Gamari
Well-Typed
117 Middle Rd.
Portsmouth, NH 03801
United States

Email: ben@well-typed.com

Henk Birkholz
Fraunhofer Institute for Secure Information Technology
Rheinstrasse 75
Darmstadt 64295
Germany

Email: henk.birkholz@sit.fraunhofer.de