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SenML Data Value Content-Format Indication
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Abstract

The Sensor Measurement Lists (SenML) media type supports multiple types of values, from numbers to text strings and arbitrary binary data values. In order to simplify processing of the data values this document proposes to specify a new SenML field for indicating the Content-Format of the data.

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Table of Contents

1. Introduction	2
2. Terminology	3
3. SenML Content-Format ("ct") Field	3
4. SenML Base Content-Format ("bct") Field	4
5. Mandatory to Understand Content-Format	4
6. Examples	4
7. Security Considerations	5
8. IANA Considerations	5
Acknowledgements	5
10. References	6
10.1. Normative References	6
10.2. Informative References	6
Authors' Addresses	7

1. Introduction

The Sensor Measurement Lists (SenML) media type [RFC8428] can be used to send various different kinds of data. In the example given in Figure 1, a temperature value, an indication whether a lock is open, and a data value (with SenML field "vd") read from an NFC reader is sent in a single SenML pack.

```
[
  {"bn":"urn:dev:ow:10e2073a01080063:", "n":"temp", "u":"Cel", "v":7.1},
  {"n":"open", "vb":false},
  {"n":"nfc-reader", "vd":"aGkgCg"}
]
```

Figure 1: SenML pack with unidentified binary data

The receiver is expected to know how to interpret the data in the "vd" field based on the context, e.g., name of the data source and out-of-band knowledge of the application. However, this context may not always be easily available to entities processing the SenML pack. To facilitate automatic interpretation it is useful to be able to indicate an Internet media type and content-coding right in the SenML Record. The CoAP Content-Format (Section 12.3 in [RFC7252]) provides just this information; enclosing a Content-Format number (in this case number 60 as defined for content-type application/cbor in [RFC7049]) in the Record is illustrated in Figure 2. All registered CoAP Content-Formats are listed in the Content-Formats subregistry of the CoRE Parameters registry [IANA.core-parameters].

```
{"n":"nfc-reader", "vd":"gmNmb28YKg", "ct":"60"}
```

Figure 2: SenML Record with binary data identified as CBOR

In this example SenML Record the data value contains a string "foo" and a number 42 encoded in a CBOR [RFC7049] array. Since the example above uses the JSON format of SenML, the data value containing the binary CBOR value is base64-encoded. The data value after base64 decoding is shown with CBOR diagnostic notation in Figure 3.

```
82          # array(2)
 63          # text(3)
 666F66F    # "foo"
18 2A       # unsigned(42)
```

Figure 3: Example Data Value in CBOR diagnostic notation

2. 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.

Readers should also be familiar with the terms and concepts discussed in [RFC8428]. Awareness of terminology issues discussed in [I-D.bormann-core-media-content-type-format] can also be very helpful.

3. SenML Content-Format ("ct") Field

When a SenML Record contains a Data Value field ("vd"), the Record MAY also include a Content-Format indication field. The Content-Format indication uses label "ct" and a string value with either a CoAP Content-Format identifier in decimal form with no leading zeros except for the value "0" itself (representing an unsigned integer in the range of 0-65535, similar to the CoRE Link Format [RFC6690] "ct" attribute) or with a string containing a Content-Type and optionally a Content-Coding (see below).

The CoAP Content-Format identifier provides a simple and efficient way to indicate the type of the data. Since some Internet media types and their content coding and parameter alternatives do not have assigned CoAP Content-Format identifiers, using Content-Type and Content-Coding is also allowed. Both methods use a string value in the "ct" field to keep its data type consistent across uses. When

the "ct" field contains only digits, it is interpreted as a CoAP Content-Format identifier.

To indicate that a Content-Coding is used with a Content-Type, the Content-Coding value (e.g., "deflate" [RFC7230]) is appended to the Content Type (media type and parameters, if any), separated by a "@" sign. For example: "text/plain; charset=utf-8@deflate". If Content-Coding is not specified with a Content-Type (no "@" sign is present outside any media type parameters), the identity (i.e., no) transformation is used.

4. SenML Base Content-Format ("bct") Field

The Base Content-Format Field, label "bct", provides a default value for the Content-Format Field (label "ct") within its range. The range of the base field includes the Record containing it, up to (but not including) the next Record containing a "bct" field, if any, or up to the end of the pack otherwise. Resolution (Section 4.6 of [RFC8428]) of this base field is performed by adding its value with the label "ct" to all Records in this range that carry a "vd" field but do not already contain a Content-Format ("ct") field.

5. Mandatory to Understand Content-Format

If the Content-Format field needs to be understood by all processors of the SenML Pack, the mandatory to understand versions of the fields, "ct_" and "bct_", can be used. These fields have identical semantics to the "ct" and "bct" fields respectively except that a SenML processor that does not support this specification would reject a SenML Pack with such fields and generate an error (see Section 4.4 of [RFC8428]).

Using the regular Content-Format indication enables to use this extension in a backward compatible way to indicate information that is not critical to be understood. The choice between the two methods is application dependent.

If both a "ct_" field and a "ct" field are present in a resolved Record (i.e., from fields in the Record or from base fields), the "ct_" field overrides the "ct" field. Using both "ct" and "ct_" in the same Record is NOT RECOMMENDED as it MAY be treated as an error by the recipient.

6. Examples

The following examples are valid values for the "ct" and "bct" fields (explanation/comments in parenthesis):

- o "60" (CoAP Content-Format for "application/cbor")
- o "0" (CoAP Content-Format for "text/plain" with parameter "charset=utf-8")
- o "application/json" (JSON Content-Type - equivalent to "50" CoAP Content-Format identifier)
- o "application/json@deflate" (JSON Content-Type with "deflate" as Content-Coding - equivalent to "11050" CoAP Content-Format identifier)
- o "text/csv" (Comma-Separated Values (CSV) [RFC4180] Content-Type)
- o "text/csv@gzip" (CSV with "gzip" as Content-Coding)

7. Security Considerations

The indication of a media type in the data does not exempt a consuming application from properly checking its inputs. Also, the ability for an attacker to supply crafted SenML data that specify media types chosen by the attacker may expose vulnerabilities of handlers for these media types to the attacker.

8. IANA Considerations

(Note to RFC Editor: Please replace all occurrences of "RFC-AAAA" with the RFC number of this specification and remove this note.)

IANA is requested to assign new labels in the "SenML Labels" subregistry of the SenML registry [IANA.senml] (as defined in [RFC8428]) for the Content-Format indication as per Table 1:

Name	Label	JSON Type	XML Type	Reference
Base Content-Format	bct	String	string	RFC-AAAA
Content-Format	ct	String	string	RFC-AAAA

Table 1: IANA Registration for new SenML Labels

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10. References

10.1. Normative References

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