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Semantic Definition Format (SDF): Mapping files

Abstract

The Semantic Definition Format (SDF) is a format for domain experts
to use in the creation and maintenance of data and interaction
models that describe Things, i.e., physical objects that are
available for interaction over a network. It was created as a common
language for use in the development of the One Data Model liaison
organization (OneDM) definitions. Tools convert this format to
database formats and other serializations as needed.

An SDF specification often needs to be augmented by additional
information that is specific to its use in a particular ecosystem or
application. SDF mapping files provide a mechanism to represent this
augmentation.

About This Document

This note is to be removed before publishing as an RFC.

Status information for this document may be found at https://
datatracker.ietf.org/doc/draft-bormann-asdf-sdf-mapping/.

Discussion of this document takes place on the A Semantic Definition
Format for Data and Interactions of Things (asdf) Working Group
mailing list (mailto:asdf@ietf.org), which is archived at https://
mailarchive.ietf.org/arch/browse/asdf/. Subscribe at https://
www.ietf.org/mailman/listinfo/asdf/.

Source for this draft and an issue tracker can be found at https://
github.com/cabo/sdf-mapping.

Status of This Memo

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 5 June 2024.

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1. Introduction

The Semantic Definition Format (SDF) is a format for domain experts to use in the creation and maintenance of data and interaction models that describe Things, i.e., physical objects that are available for interaction over a network. It was created as a common language for use in the development of the One Data Model liaison

organization (OneDM) definitions. Tools convert this format to
database formats and other serializations as needed.

An SDF specification often needs to be augmented by additional
information that is specific to its use in a particular ecosystem or
application. SDF mapping files provide a mechanism to represent this
augmentation.

1.1. Terminology and Conventions

The definitions of [I-D.ietf-asdf-sdf] apply.

The term "byte" is used in its now-customary sense as a synonym for
"octet".

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. Overview

An SDF mapping file provides augmentation information for one or
more SDF definitions. Its main contents is a map from SDF name
references (Section 4.3 of [I-D.ietf-asdf-sdf]) to a set of
qualities.

When processing the mapping file together with one or more SDF
definitions, these qualities are added to the SDF definition at the
referenced name, as in a merge-patch operation [RFC7396]. Note that
this is somewhat similar to the way sdfRef (Section 4.4 of
[I-D.ietf-asdf-sdf]) works, but in a mapping file the arrows point
in the inverse direction (from the augmenter to the augmented).

2.1. Example Definition 1 (ecosystem: IPSO/OMA)

An example for an SDF mapping file is given in Figure 1. This
mapping file is meant to attach to an SDF specification published by
OneDM, and to add qualities relevant to the IPSO/OMA ecosystem.
Note that this example uses namespaces to identify elements of the
referenced specification(s), but has un-namespaced quality names.
These two kinds of namespaces are probably unrelated, and we may
need to add quality namespacing to SDF (independent of a potential
feature to add namespace references to definitions that are not
intended to go into the default namespace — these are SDF definition
namespaces and not quality namespaces, which are one meta-level
higher).

   *Start of mapping file for certain OneDM playground models:

```
{
  "info": {
    "title": "IPSO ID mapping"
  },
  "namespace": {
    "onedm": "https://onedm.org/models"
  },
  "defaultNamespace": "onedm",
  "map": {
    "#/sdfObject/Digital_Input": {
      "id": 3200
    },
    "#/sdfObject/Digital_Input/sdfProperty/Digital_Input_State": {
      "id": 5500
    },
    "#/sdfObject/Digital_Input/sdfProperty/Digital_Input_Counter": {
      "id": 5501
    }
  }
}
```

Figure 1: A simple example of an SDF mapping file

2.2. Example Definition 2 (ecosystem: W3C WoT)

This example shows a translation of a hypothetical W3C WoT Thing
Model into an SDF model plus a mapping file to catch Thing Model
attributes that don't currently have SDF qualities defined.
The example probably would be more useful with, say, protocol
bindings. This is left for a future version of this example, and/or
a future specification that specifically addresses how to map Thing
Models into SDF.
(There is also the separate requirement to transform a Thing
Description into the kind of information that can be represented in
SDF plus instance information, such as IP addresses or specific node
names.)
Finally, namespaces are all wrong in this example.

  *The input: WoT Thing Model

```
{
    "@context": ["http://www.w3.org/ns/td"],
    "@type" : "tm:ThingModel",
    "title": "Lamp Thing Model",
    "titles": {
      "en": "Lamp Thing Model",
      "de": "Thing Model für eine Lampe"
    },
    "properties": {
        "status": {
            "description": "Current status of the lamp",
            "descriptions": {
              "en": "Current status of the lamp",
              "de": "Aktueller Status der Lampe"
            },
            "type": "string",
            "readOnly": true
        }
    }
}
```

                    Figure 2: Input: WoT Thing Model

      *The output: SDF model

```
{
  "info": {
    "title": "Lamp Thing Model"
  },
  "namespaces": {
    "wot": "http://www.w3.org/ns/td"
  },
  "defaultNamespace": "wot",
  "sdfObject": {
    "LampThingModel": {
      "label": "Lamp Thing Model",
      "sdfProperty": {
        "status": {
          "description": "Current status of the lamp",
          "writable": false,
          "type": "string"
        }
      }
    }
  }
}
```

```
                   Figure 3: Output 1: SDF Model


      *The other output: SDF mapping file



{
  "info": {
    "title": "Lamp Thing Model: WoT TM mapping"
  },
  "namespace": {
    "wot": "http://www.w3.org/ns/td"
  },
  "defaultNamespace": "wot",
  "map": {
    "#/sdfObject/LampThingModel": {
      "titles": {
        "en": "Lamp Thing Model",
        "de": "Thing Model für eine Lampe"
      }
    },
    "#/sdfObject/LampThingModel/sdfProperty/status": {
      "descriptions": {
        "en": "Current status of the lamp",
        "de": "Aktueller Status der Lampe"
      }
    }
  }
}
```

Figure 4: Output 2: SDF Mapping File

3. Formal Syntax of SDF mapping files

An SDF mapping file has three optional components that are taken
unchanged from SDF: The info block, the namespace declaration, and
the default namespace. The mandatory fourth component, the "map",
contains the mappings from an SDF name reference (usually a
namespace and a JSON pointer) to a nested map providing a set of
qualities to be merged in at the site identified in the name
reference.

Figure 5 describes the syntax of SDF mapping files using CDDL
[RFC8610].

```
start = sdf-mapping

sdf-mapping = {
 ; info will be required in most process policies
 ? info: sdfinfo
 ? namespace: named<text>
 ? defaultNamespace: text
 map: { * global-sdf-pointer => additionalqualities}
}

; we can't really be much more specific here:
additionalqualities = named<any>

; -------------------------------- import from SDF-base:

sdfinfo = {
 ? title: text
 ? description: text
 ? version: text
 ? copyright: text
 ? license: text
 ? modified: modified-date-time
 ? features: [
              * (any .feature "feature-name") ; EXTENSION-POINT
            ]
 optional-comment
 EXTENSION-POINT<"info-ext">
}

; Shortcut for a map that gives names to instances of X
; (has keys of type text and values of type X)
named<X> = { * text => X }

; EXTENSION-POINT is only used in framework syntax
EXTENSION-POINT<f> = ( * (quality-name .feature f) => any )
quality-name = text .regexp "([a-z][a-z0-9]*:)?[a-z$][A-Za-z$0-9]*"

; rough CURIE or JSON Pointer syntax:
global-sdf-pointer = text .regexp ".*[:#].*"

optional-comment = (
 ? $comment: text        ; source code comments only, no semantics
)

modified-date-time = text .abnf modified-dt-abnf
modified-dt-abnf = "modified-dt" .det rfc3339z

; RFC 3339 sans time-numoffset, slightly condensed
rfc3339z = '
   date-fullyear   = 4DIGIT
```

```
date-month      = 2DIGIT  ; 01-12
date-mday       = 2DIGIT  ; 01-28, 01-29, 01-30, 01-31 based on
                          ; month/year
time-hour       = 2DIGIT  ; 00-23
time-minute     = 2DIGIT  ; 00-59
time-second     = 2DIGIT  ; 00-58, 00-59, 00-60 based on leap sec
                          ; rules
time-secfrac    = "." 1*DIGIT
DIGIT           =  %x30-39 ; 0-9

partial-time    = time-hour ":" time-minute ":" time-second
                  [time-secfrac]
full-date       = date-fullyear "-" date-month "-" date-mday

modified-dt     = full-date ["T" partial-time "Z"]
```
'

Figure 5: CDDL definition of SDF mapping file

4. IANA Considerations

4.1. Media Type

IANA is requested to add the following Media-Type to the "Media Types" registry.

Name	Template	Reference
sdf-mapping+json	application/sdf-mapping+json	RFC XXXX, Section 4.1

Table 1: A media type for SDF mapping files

RFC Editor: please replace RFC XXXX with this RFC number and remove this note.

Type name: application
Subtype name: sdf-mapping+json
Required parameters: none
Optional parameters: none
Encoding considerations: binary (JSON is UTF-8-encoded text)
Security considerations: Section 5 of RFC XXXX
Interoperability considerations: none
Published specification: Section 4.1 of RFC XXXX
Applications that use this media type: Tools for data and
    interaction modeling that describes Things, i.e., physical
    objects that are available for interaction over a network
Fragment identifier considerations: A JSON Pointer fragment
    identifier may be used, as defined in Section 6 of [RFC6901].
Person & email address to contact for further information: ASDF WG
    mailing list (asdf@ietf.org), or IETF Applications and Real-Time
    Area (art@ietf.org)
Intended usage: COMMON
Restrictions on usage: none
Author/Change controller: IETF
Provisional registration: no

4.2. Registries

(TBD: After future additions, check if we need any.)

5. Security Considerations

Some wider issues are discussed in [RFC8576].

(Specifics: TBD.)

6. References

6.1. Normative References

[I-D.ietf-asdf-sdf] Koster, M., Bormann, C., and A. Keränen, "Semantic Definition Format (SDF) for Data and Interactions of Things", Work in Progress, Internet-Draft, draft-ietf-asdf-sdf-17, 5 November 2023, <https://datatracker.ietf.org/doc/html/draft-ietf-asdf-sdf-17>.

[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/rfc/rfc2119>.

[RFC6901] Bryan, P., Ed., Zyp, K., and M. Nottingham, Ed., "JavaScript Object Notation (JSON) Pointer", RFC 6901, DOI 10.17487/RFC6901, April 2013, <https://www.rfc-editor.org/rfc/rfc6901>.

[RFC7396] Hoffman, P. and J. Snell, "JSON Merge Patch", RFC 7396, DOI 10.17487/RFC7396, October 2014, <https://www.rfc-editor.org/rfc/rfc7396>.

[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/rfc/rfc8174>.

[RFC8610] Birkholz, H., Vigano, C., and C. Bormann, "Concise Data Definition Language (CDDL): A Notational Convention to Express Concise Binary Object Representation (CBOR) and JSON Data Structures", RFC 8610, DOI 10.17487/RFC8610, June 2019, <https://www.rfc-editor.org/rfc/rfc8610>.

6.2. Informative References

[RFC8576] Garcia-Morchon, O., Kumar, S., and M. Sethi, "Internet of Things (IoT) Security: State of the Art and Challenges", RFC 8576, DOI 10.17487/RFC8576, April 2019, <https://www.rfc-editor.org/rfc/rfc8576>.

Acknowledgements

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