Workgroup: ASDF
Internet-Draft:
draft-bormann-asdf-sdf-mapping-01
Published: 24 October 2022
Intended Status: Standards Track
Expires: 27 April 2023
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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 in the Internet of Things. 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

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 27 April 2023.



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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 in the Internet of Things. 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, but omission is
 ; not a syntax error:
 ? info: sdfinfo
 ? namespace: named<text>
 ? defaultNamespace: text
 ? map: { * sdf-pointer => additionalqualities}
}

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

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

sdfinfo = {
 ? title: text
 ? version: text
 ? copyright: text
 ? license: text
 EXTENSION-POINT<"info-ext">
}

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

; only used in framework syntax:
EXTENSION-POINT<f> = ( * (text .feature f) => any )

sdf-pointer = text ; .regexp curie-regexp -- TO DO!
```

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 in the Internet of Things
**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. and C. Bormann, "Semantic Definition Format (SDF) for Data and Interactions of Things", Work in Progress, Internet-Draft, draft-ietf-asdf-sdf-12, 30 June 2022, <https://www.ietf.org/archive/id/draft-ietf-asdf-sdf-12.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>.

**[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/info/rfc6901>.

**[RFC7396]** Hoffman, P. and J. Snell, "JSON Merge Patch", RFC 7396, DOI 10.17487/RFC7396, October 2014, <https://www.rfc-editor.org/info/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/info/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/info/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/info/rfc8576>.

## Acknowledgements

This draft is based on discussions in the Thing-to-Thing Research Group (T2TRG) and the SDF working group. Input for Section 2.1 was provided by Ari Keränen.

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