ASDF WG
Internet-Draft
Intended status: Standards Track
Expires: 22 June 2026

C. Bormann
Universit辰t Bremen TZI
A. Ker辰nen
Ericsson

19 December 2025

An sdfType for Links
draft-ietf-asdf-sdftype-link-01

Abstract

This document defines and registers an sdfType "link" for the Semantic Definition Format (SDF) for Data and Interactions of Things (draft-ietf-asdf-sdf).

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-ietf-asdf-sdftype-link/.

Discussion of this document takes place on the A Semantic Definition Format for Data and Interactions of Things 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/sdftype-link.

Status of This Memo

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

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute 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 22 June 2026.

Table of Contents

1. Introduction

The Semantic Definition Format for Data and Interactions of Things (SDF, [I-D.ietf-asdf-sdf]) is a format for domain experts to use in the creation and maintenance of data and interaction models in the Internet of Things.

A common data type that occurs in the modeling of IoT devices is the _link_. [RFC8288] defines the concept of Web Linking, which, apart from the target URI that any link will contain, can provide additional parameters, such as the "link relation type" that explains the relationship expressed by the link, as well as "target attributes" that provide additional information about the target of the link (without a need to "dereference", i.e., follow, the link).

This document defines and registers an sdfType "link" for the Semantic Definition Format. This type models an abstract "serialization" [RFC8288] of a link, in a way that is compatible with the way SDF maps information models to its data modeling language.

1.1. Conventions and Definitions

The definitions of [RFC6690], [RFC8288], and [I-D.ietf-asdf-sdf] apply.

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 [BCP14] (RFC2119) (RFC8174) when, and only when, they appear in all capitals, as shown here.

2. The sdfType "link"

The sdfType "link" is intended to be used with the SDF "type" of "object". The members of that object are strings that are named the same as the link parameter (attribute) names. The special parameter name "href" is used to express the link target. (Parameter names specific to the Constrained RESTful Environment (CoRE) are also discussed in [RFC9423].)

Note that attribute names and relation type names are case-insensitive in [RFC8288]. Strings that are case-insensitive in [RFC8288] MUST be in their lowercase form when used in this specification.

An example for the instance of a link is provided in Section 5 of [RFC6690]:

```
</sensors/temp>;rt="temperature-c";if="sensor",
```

To hold a link like this, we could describe an SDF affordance that is specific on the target attributes above, but does not contain instance-specific (run-time) information on the actual URI that points to the link target. An sdfProperty for that could look like:

```
{
 "sdfProperty": {
  "temp-c-link": {
   "type": "object",
   "sdfType": "link",
   "properties": {
     "href": { "type": "string"},
     "rt": { "type": "string", "const": "temperature-c"},
     "if": { "type": "string", "const": "sensor"}
   }
  }
 }
}
```

Further examples that show sdfType "link" in context are in Appendix A.

3. Discussion

Links play an important role in SDF modeling both during definition time (for adding information to a model, such as in sdfRef) and during run time (for making links to instances into a subject of data and interaction modeling). The present document is an early attempt at addressing the run-time usage of links, in particular links that fit the Web Linking [RFC8288] abstractions. A related draft [I-D.laari-asdf-relations] addresses definition-time links, but does seem to touch modeling run-time use of links as well (e.g., by discussing "writable" link relations).

Not all links used in ecosystems are based on URIs. E.g., OMA has "object links", which are basically pairs of numbers (object/instance). These ecosystem links may have some structure that should be modeled in the SDF model (e.g., where the object id part of a link always has to have a specific value). This structure can be mapped into URI strings using some convention, e.g., an OMA object link could be oma-object:3303:0 (where oma-object is placeholder for a URI scheme to be defined). However, burying structural components of the ecosystem-specific link in a string syntax makes it hard to access and control those components from the model.

TODO: Examples are needed to show how the OCF collection pattern is addressed by the current specification.

4. Security Considerations

The security considerations of [RFC8288] apply in a general way, although modeling a link as a datatype does not incur all of the security considerations that will apply to actually interchanging these links.

(TODO)

5. IANA Considerations

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

IANA is requested to register the sdfType "link" in the "sdfType Values" sub-registry in the "SDF Parameters" registry, with the following completion for the registration template:

Name	Description	type	JSON Representation	Reference
link	A Web Link [RFC8288]	object	object members for link attributes	RFCXXXX

Table 1: Registration for sdfType "link"

6. References

6.1. Normative References

[BCP14] Best Current Practice 14, <https://www.rfc-editor.org/info/bcp14>. At the time of writing, this BCP comprises the following:

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>.

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>.

[I-D.ietf-asdf-sdf] Koster, M., Bormann, C., and A. Ker辰nen, "Semantic Definition Format (SDF) for Data and Interactions of Things", Work in Progress, Internet-Draft, draft-ietf-

asdf-sdf-25, 13 October 2025,
<https://datatracker.ietf.org/doc/html/draft-ietf-asdf-sdf-25>.

[RFC8288] Nottingham, M., "Web Linking", RFC 8288, DOI 10.17487/RFC8288, October 2017, <https://www.rfc-editor.org/rfc/rfc8288>.

6.2. Informative References

[I-D.laari-asdf-relations]
Laari, P., "Extended relation information for Semantic Definition Format (SDF)", Work in Progress, Internet-Draft, draft-laari-asdf-relations-04, 28 January 2025, <https://datatracker.ietf.org/doc/html/draft-laari-asdf-relations-04>.

[RFC6690] Shelby, Z., "Constrained RESTful Environments (CoRE) Link Format", RFC 6690, DOI 10.17487/RFC6690, August 2012, <https://www.rfc-editor.org/rfc/rfc6690>.

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

[RFC8792] Watsen, K., Auerswald, E., Farrel, A., and Q. Wu, "Handling Long Lines in Content of Internet-Drafts and RFCs", RFC 8792, DOI 10.17487/RFC8792, June 2020, <https://www.rfc-editor.org/rfc/rfc8792>.

[RFC9423] Bormann, C., "Constrained RESTful Environments (CoRE) Target Attributes Registry", RFC 9423, DOI 10.17487/RFC9423, April 2024, <https://www.rfc-editor.org/rfc/rfc9423>.

Appendix A. Examples

sdfType "link" can be used to specify links with information specific to an organization's ecosystem. In many cases, sdfRef (see Section 4.4 of [I-D.ietf-asdf-sdf]) provides a convenient way to assemble the link specification from elements that are generic for an organization and elements that are specific to the model being defined.

> | Note that sdfRef operates by applying the JSON Merge Patch
> | algorithm [RFC7396] to patch the contents of the definition
> | found at the global name (see Section 4 of [I-D.ietf-asdf-sdf])
> | with the contents of the original JSON map, i.e., the

| definition containing the sdfRef quality with the entry for the
| sdfRef quality removed. The result of that Merge Patch is then
| used in place of the value of the original JSON map.

A.1. Constructing a Link from an Organization's Ecosystem

If the organization example.com provides a definition for an idlink that is intended to be referenced to obtain more information about the sdfObject myObj, this could look like:

```
{
  "namespaces": {
    "org": "https://models.example.com/",
    "orgtypes": "https://models.example.com/#/sdfData/"
  },
  "defaultNamespace": "org",
  "sdfObject": {
    "myObj": {
      "sdfProperty": {
        "linkToInformation": {
          "description": "More info about foo",
          "sdfRef": "orgtypes:idlink"
        }
      }
    }
  }
}
```

This example assumes example.com has exported a definition for idlink such as the following:

```
{
  "namespace": {
    "org": "https://models.example.com/"
  },
  "sdfData": {
    "idlink": {
      "description": "Special kind of link type example org uses",
      "type": "object",
      "sdfType": "link",
      "properties": {
        "href": {
          "type": "string"
        },
        "id": {
          "type": "integer",
          "minvalue": 0,
          "maxvalue": 255,
          "description":
            "Special identifier for metadata about this link"
        }
      }
    }
  }
}
```

A.2. Using with OMA test object

As a more specific example, the following assumes that openmobilealliance.org has provided a definition under objlink for the Object Links defined for LwM2M.
// Add reference!

```
=============== NOTE: '\' line wrapping per RFC 8792 ================

{
  "info": {
    "title": "OMA LwM2M LwM2M v1.1 Test Object (Object ID 3442)",
    "version": "2025-05-05",
    "copyright": "Copyright (c) 2018-2020 IPSO",
    "license": "BSD-3-Clause"
  },
  "namespace": {
    "oma": "https://models.openmobilealliance.org/",
    "omatypes": "https://models.openmobilealliance.org/#/sdfData/"
  },
  "defaultNamespace": "oma",
  "sdfObject": {
    "LwM2M_v1.1_Test_Object": {
      "label": "LwM2M v1.1 Test Object",
      "$comment": "Simplified version of OMA Test Object with only \
                                              two link type resources",
      "oma:id": 3442,
      "sdfProperty": {
        "ObjLink_Value": {
          "label": "ObjLnk Value",
          "description": "Initial value must be a link to instance \
                                          0 of Device Object 3 (3:0).",
          "oma:id": 170,
          "sdfRef": "omatypes:objlink",
          "properties": {
            "object-instance-id": {
              "$comment": "Example of refinement of link attribute",
              "maximum": 42
            }
          }
        },
        "CoreLnk_Value": {
          "label": "CoreLnk Value",
          "description": "Initial value must be \"</3442>\".",
          "oma:id": 180,
          "sdfRef": "omatypes:corelink"
        }
      }
    }
  }
}
```

The following is a potential definition that openmobilealliance.org could export that provides sdfRef-friendly descriptions of LwM2M core links as well as the more LwM2M specific object links:

```
   =============== NOTE: '\' line wrapping per RFC 8792 ================

   {
     "info": {
       "description":
         "Common data type definitions for OMA LwM2M models",
       "copyright": "Copyright 2025 Open Mobile Alliance",
       "license": "BSD-3-Clause"
     },
     "namespace": {
       "oma": "https://models.openmobilealliance.org/"
     },
     "defaultNamespace": "oma",
     "sdfData": {
       "corelink": {
         "description": "CoRE link format link",
         "$comment": "See https://md2html-tool.com/docs/\
   OpenMobileAlliance/LwM2M/master/e58dc1c/TS_Core/OMA-TS-\
   LightweightM2M_Core-V1_2_2-20240613-A_full.html#Table-732-1-\
                               lessNOTIFICATIONgreater-class-Attributes",
         "type": "object",
         "sdfType": "link",
         "properties": {
           "href": {
             "type": "string"
           },
           "pmin": {
             "type": "integer",
             "minimum": 0
           },
           "pmax": {
             "type": "integer",
             "minimum": 0
           },
           "gt": {
             "type": "number"
           },
           "lt": {
             "type": "number"
           },
           "st": {
             "type": "number"
           },
           "epmin": {
             "type": "integer",
             "minimum": 0
           },
           "epmax": {
```

```
            "type": "integer"
          },
          "edge": {
            "type": "integer",
            "minimum": 0,
            "maximum": 1
          },
          "con": {
            "type": "integer",
            "minimum": 0,
            "maximum": 1
          },
          "hqmax": {
            "type": "integer",
            "minimum": 0
          },
          "dim": {
            "type": "integer",
            "minimum": 0,
            "maximum": 65535
          },
          "ssid": {
            "type": "integer",
            "minimum": 1,
            "maximum": 65535
          },
          "uri": {
            "type": "string"
          },
          "ver": {
            "type": "string"
          },
          "lwm2m": {
            "type": "string"
          },
          "_other": {
            "type": "array",
            "items":{
              "type": "string"
            }
          }
        }
      },
      "objlink": {
        "description": "OMA LwM2M Object link",
        "type": "object",
        "sdfType": "link",
        "properties": {
```

```
          "object-id": {
            "type": "integer",
            "minimum": 0,
            "maximum": 65535
          },
          "object-instance-id": {
            "type": "integer",
            "minimum": 0,
            "maximum": 65535
          }
        }
      }
    }
  }
```

List of Tables

Table 1: Registration for sdfType "link"

Acknowledgments

Discussions in the OneDM liaison organization shaped this proposal.

Authors' Addresses

Carsten Bormann
Universit辰t Bremen TZI
Postfach 330440
D-28359 Bremen
Germany
Phone: +49-421-218-63921
Email: cabo@tzi.org

Ari Ker辰nen
Ericsson
FI-02420 Jorvas
Finland
Email: ari.keranen@ericsson.com