

A Semantic Definition Format (ASDF) for Data and Interactions of Things

ASDF BOF @ IETF 108
July 28, 2020

Note Well

- You will be recorded
- Be nice, and be professional
- The IPR guidelines of the IETF apply:
see <http://ietf.org/ipr> for details.

Repo: <https://github.com/one-data-model/ietf108>

Notes: <https://codimd.ietf.org/notes-ietf-108-asdf>

Note Well

This is a reminder of IETF policies in effect on various topics such as patents or code of conduct. It is only meant to point you in the right direction. Exceptions may apply. The IETF's patent policy and the definition of an IETF "contribution" and "participation" are set forth in BCP 79; please read it carefully.

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Definitive information is in the documents listed below and other IETF BCPs. For advice, please talk to WG chairs or ADs:

- [BCP 9](#) (Internet Standards Process)
- [BCP 25](#) (Working Group processes)
- [BCP 25](#) (Anti-Harassment Procedures)
- [BCP 54](#) (Code of Conduct)
- [BCP 78](#) (Copyright)
- [BCP 79](#) (Patents, Participation)
- <https://www.ietf.org/privacy-policy/>(Privacy Policy)



Rules of engagement

- Hold questions to the end of the presentations and only clarifying questions until we get to the discussion section
- Be polite and concise at the mic
- Keep your mics muted
- This is a non-WG forming BoF, so no charter discussion today

Agenda

(10) Tool Wastage

- (30) Intro; brief introduction into OneDM, SDF (Proponents); clarifying questions
- (20) Views of contributing ecosystems (Bluetooth, OCF, OMA [LwM2M], Zigbee) and a few interested vendors (...); clarifying questions
- (30) Discussion (beyond clarifying questions)
- (10) Calling the questions

The problem

- IoT: Many different devices
- Standards for these are being developed in different ecosystems
- “temperature sensor” in ecosystem A \neq “temperature sensor” in B
- There is no point in this diversity, and immense resources are wasted
- Harmonize device data models \rightarrow **One Data Model**
(well, there are hundreds, for **different** kinds of devices)

We don't need another wire format

- OneDM “data models” really are information models [RFC 3444], plus (Internet-side) interaction models
- Wire formats, protocol details: come up as “protocol bindings” that can be attached to these models
- Language needs to foster modeling **at the right level of abstraction**
- OneDM: not a replacement for existing wire formats or the modeling techniques specific to them

Wait, we already have...

- SenML (RFC 8428): Defines an overall data model (wire format) for data from (and to) all kinds of devices — doesn't know what a temperature sensor is
- CDDL (RFC 8610): Can be used to define actual **data models** — we were cheating a bit, this is actually about **data and interaction models**
- W3C Thing Descriptions: Define a single device (Thing) with its affordances, data models, and protocol bindings (network perspective) — **RDF**-based (JSON-LD) hypermedia format (“HTML pages for IoT devices”)
- [insert other activities here, YANG, ...]
- ASDF objective: really **help** in **harmonizing** data models for large sets of devices with enough similarities [and use the above in the process]

What not to do

HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC)

SITUATION:
THERE ARE
14 COMPETING
STANDARDS.

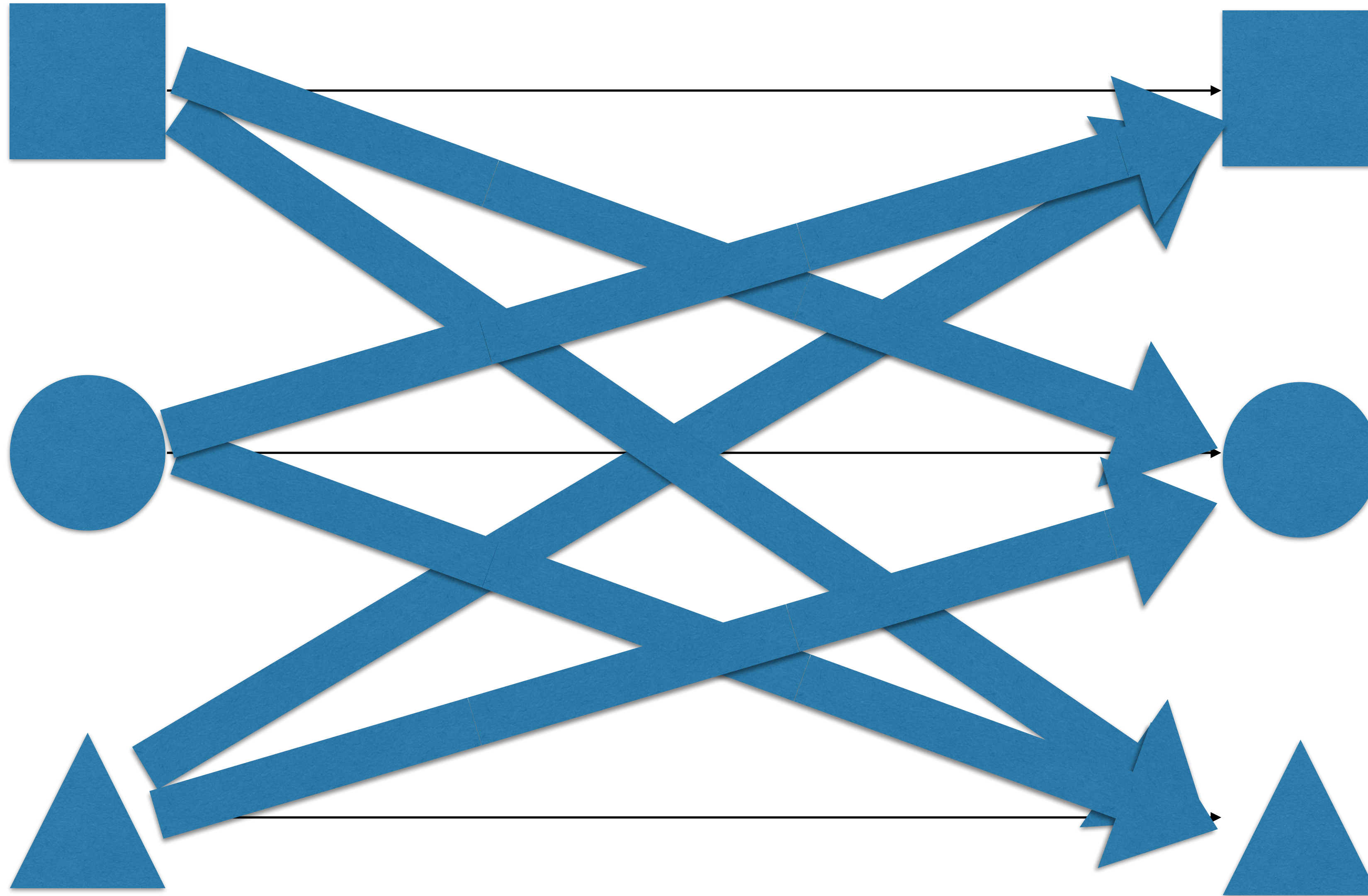
14?! RIDICULOUS!
WE NEED TO DEVELOP
ONE UNIVERSAL STANDARD
THAT COVERS EVERYONE'S
USE CASES.



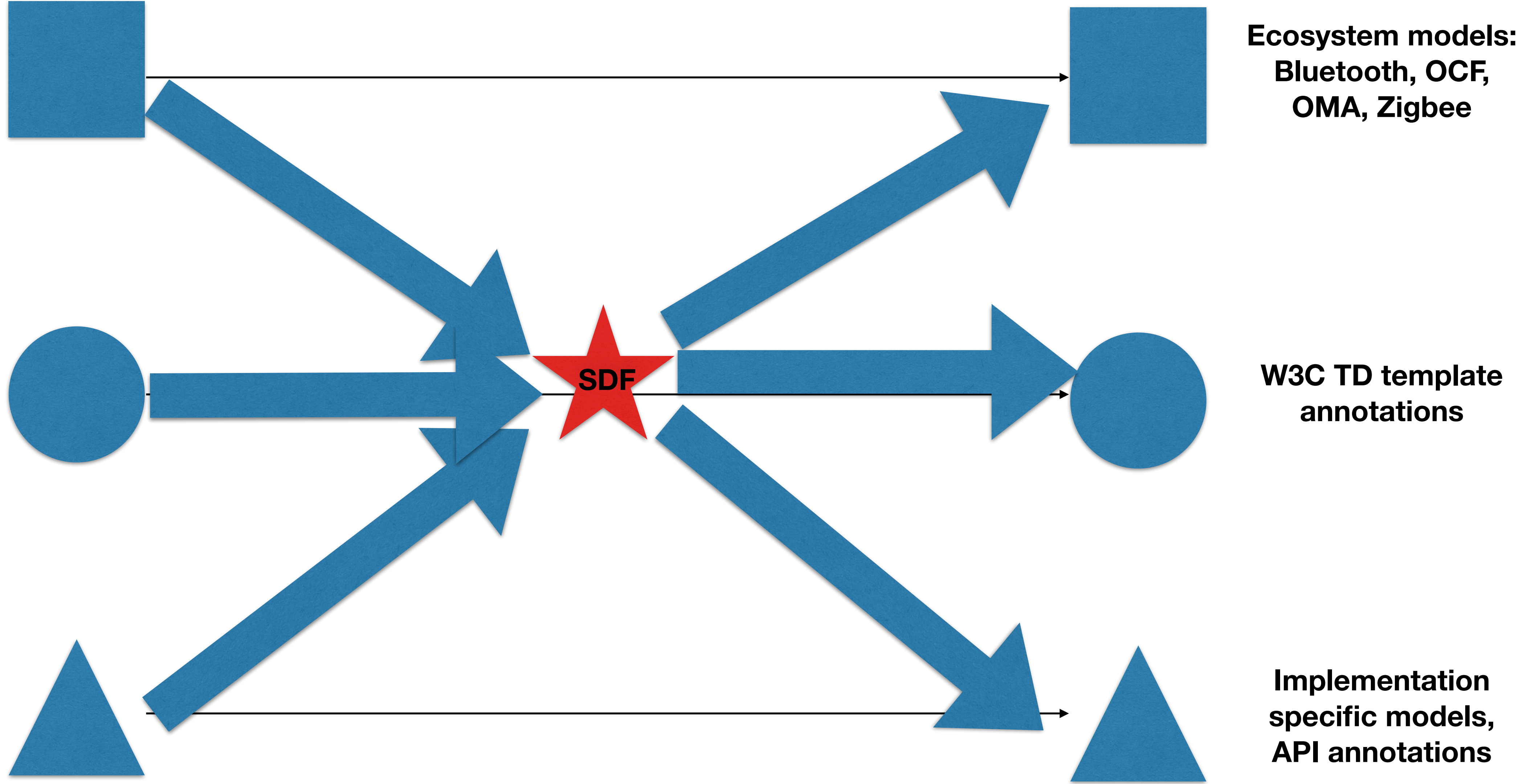
SOON:

SITUATION:
THERE ARE
15 COMPETING
STANDARDS.

$$n^2 - n$$



2n



OneDM coming-out 2020-07-13

- OneDM — “One Data Model” (<https://onedm.org>) was started as a **liaison** process 2018, after ZigBee “hive” meeting
- Liaison: Not xkcd 927, but a forum for SDOs (and large vendors) to cooperate about harmonization
 - SDOs often operate under NDAs
- OneDM ran under NDAs for a year
- 2020-07-13: OneDM decides to have its coming out

What has OneDM achieved so far?

- Agreement on a **legal model**:
 - Like the IETF did for a long time, OneDM doesn't exist as an organization (OCF did help occasionally where that was inconvenient)
 - contributions and output are BSD-3-clause **open-source** licensed: Liberal copyright license; everyone keeps their trademarks and patents
- Agreement on a basic common **specification format: SDF 1.0**
 - **This** is what this BOF is about
- Collected a couple hundred contributed **data models** in SDF from 4 SDOs (BlueTooth, OCF, OMA, ZigBee; other SDOs in the pipeline)

SDF as a “red star”

- SDF is a **format** for collaboration between different SDOs
- It avoids having to convert models between the local languages of all SDOs
- Eventually, many SDOs will use SDF as (part of) their native toolchain (some are already doing that now, informally)

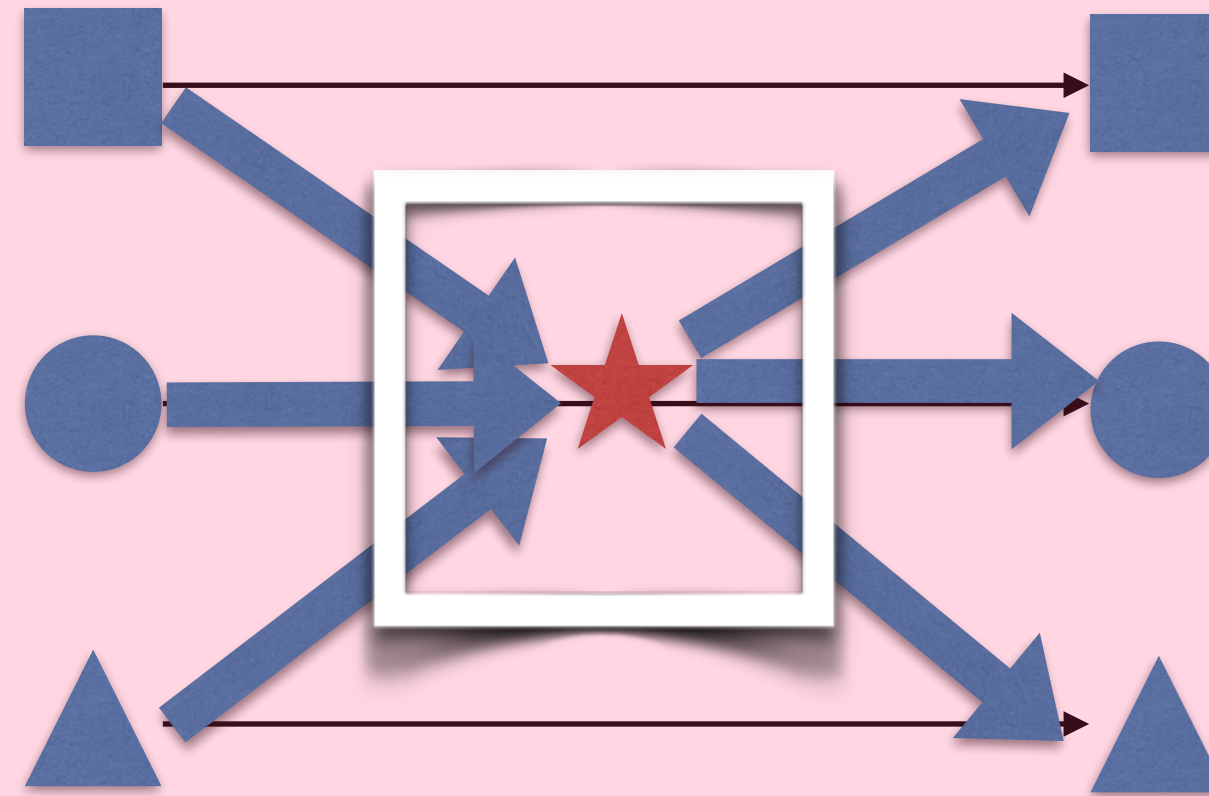
Basic Design of SDF

- SDF is a DSL (domain-specific language) represented in JSON
 - Syntax currently defined in CDDL and json-schema.org format
- SDF defines **data** models inspired by json-schema.org, augmented by some IoT considerations
- SDF's **interaction** model is based on three types of **affordances**:
Property, Action, Event
 - Each affordance is characterized by input and output data models

SDF

Standardized by

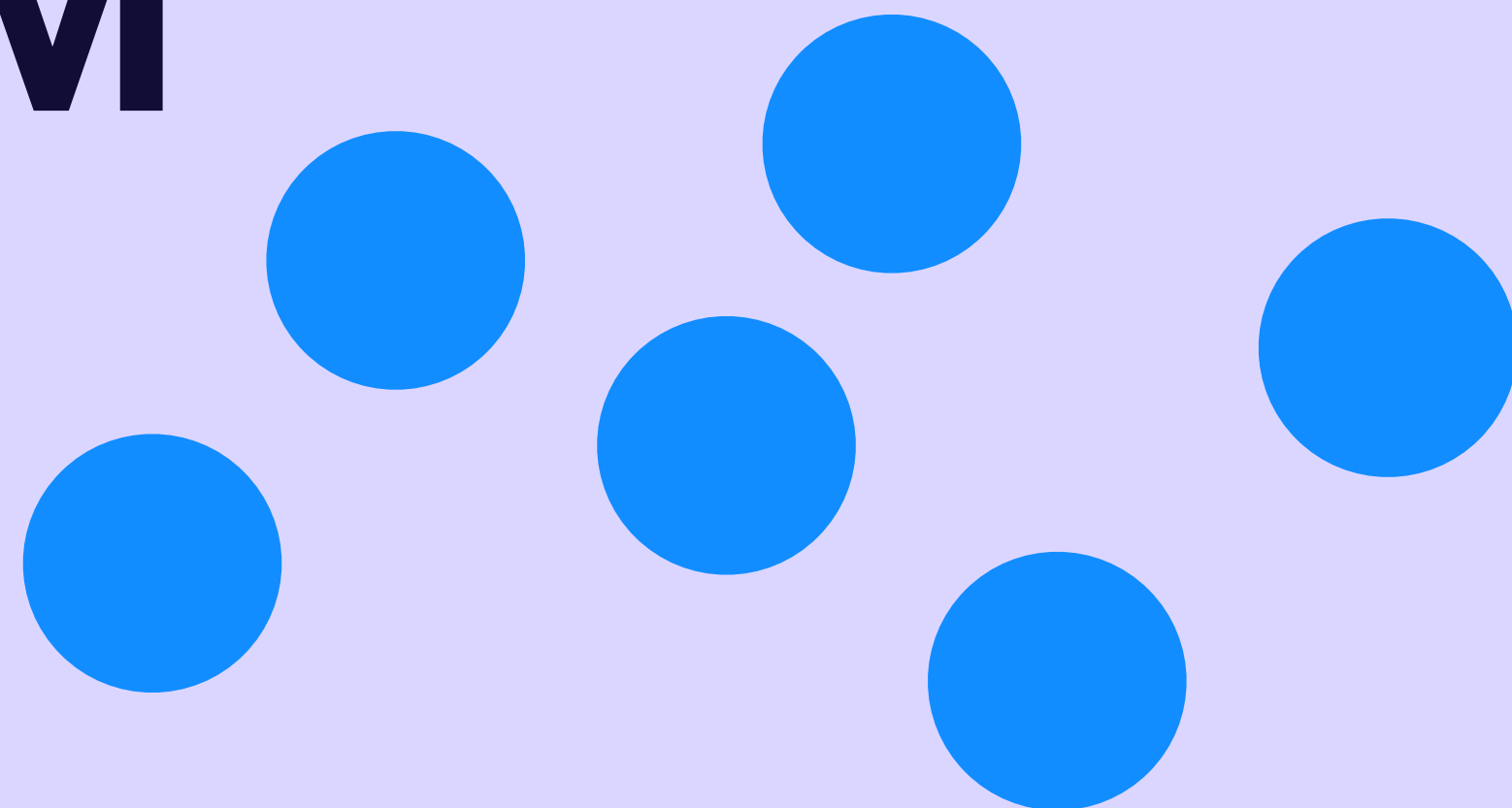
**SDF RFC-to-be
(the red star)**



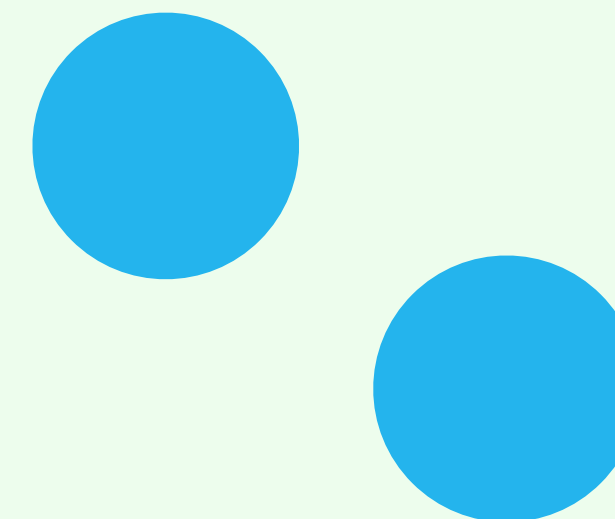
IETF

OneDM

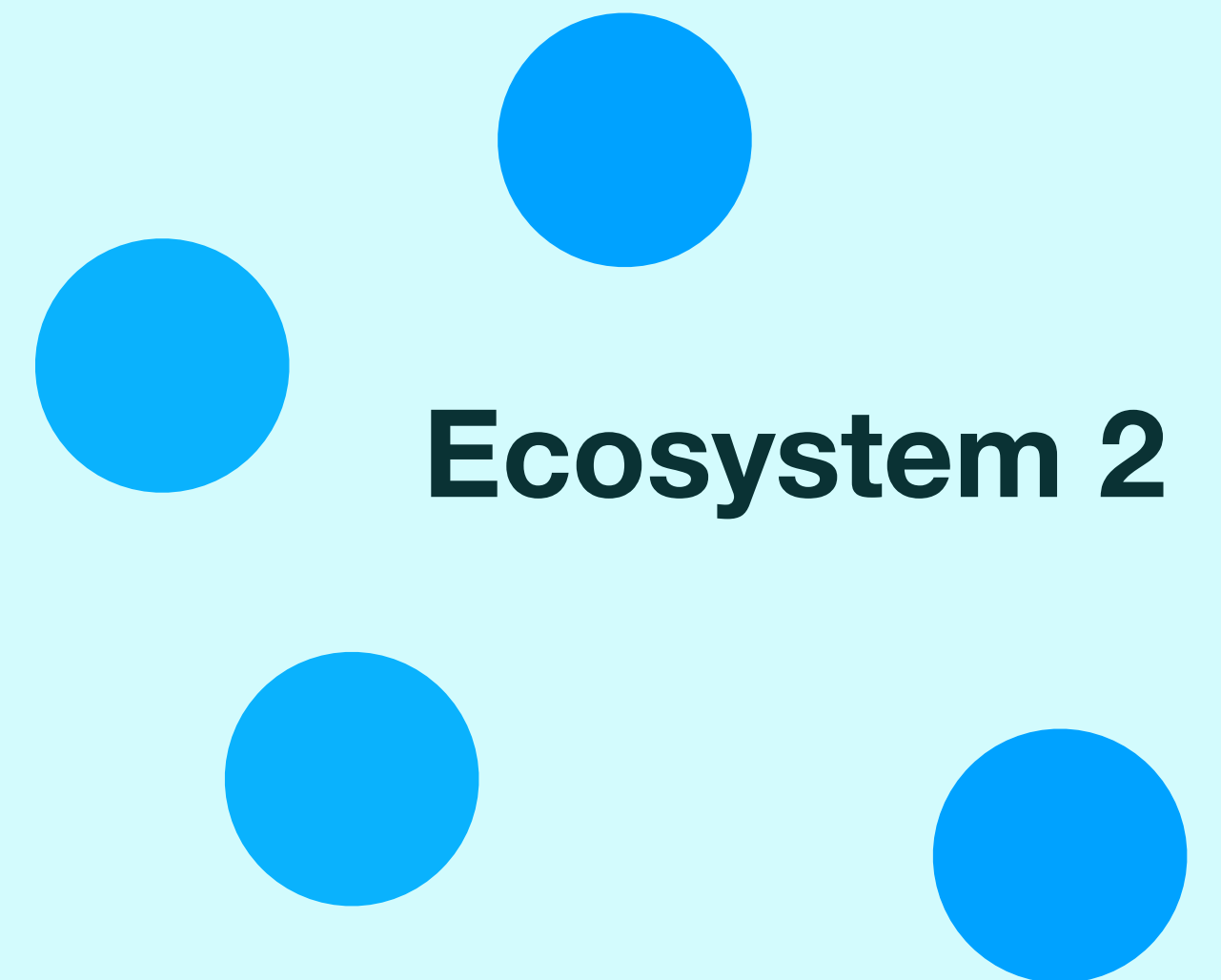
**Harmonized
Data
Models**



Ecosystem 1



Ecosystem 2



Compare: YANG

Standardized by

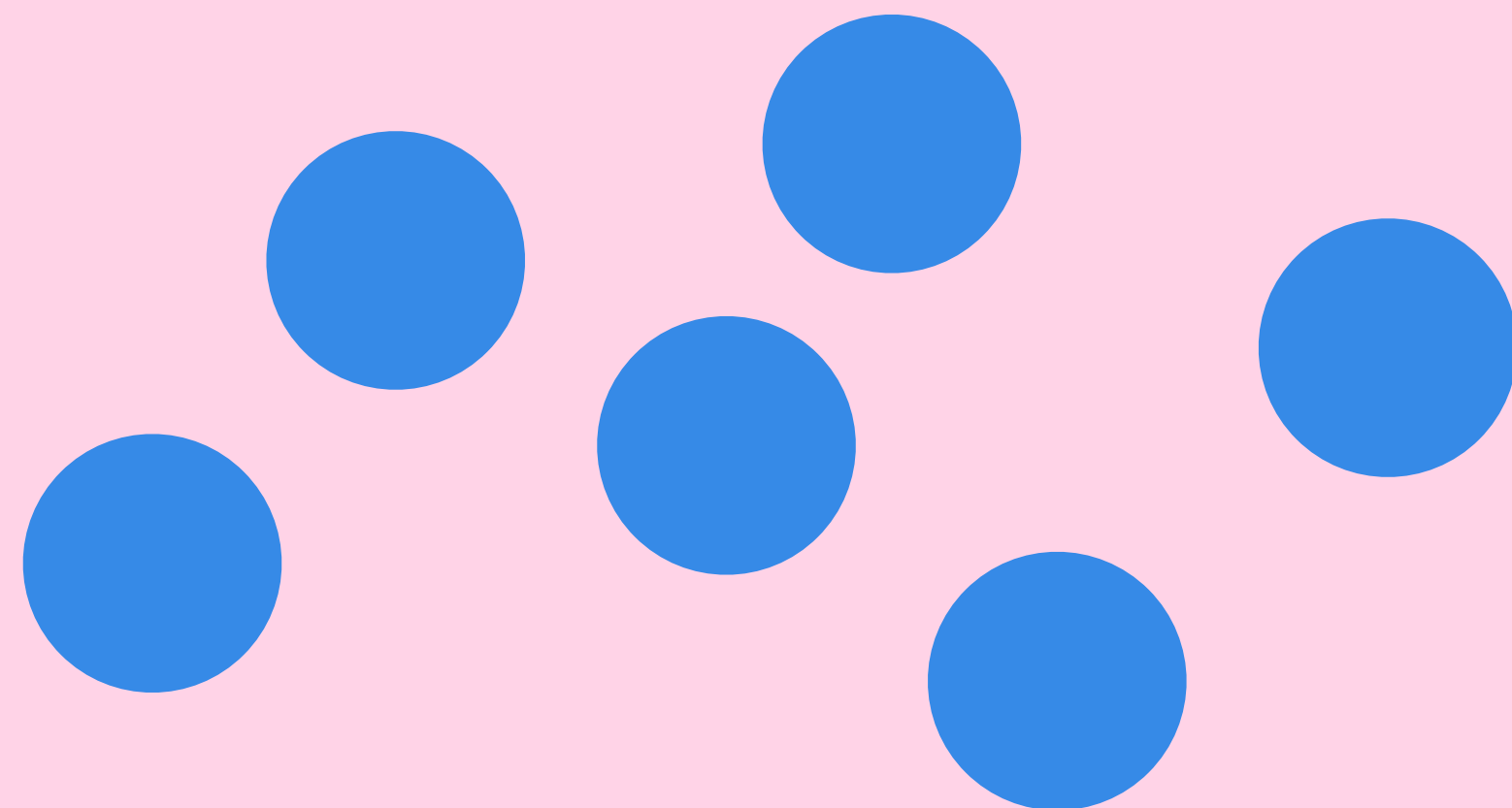
RFC 7950: YANG 1.1



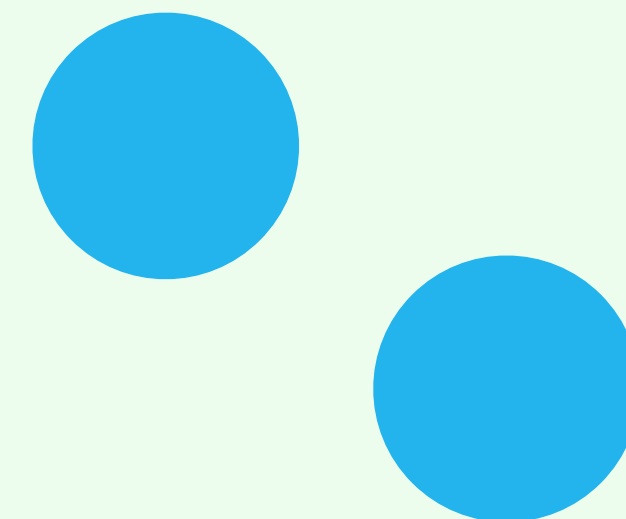
IETF

IETF

**YANG
Model
RFCs**



Vendor 2



Vendor 2



Standardizing SDF in IETF

- Start from SDF 1.0 (draft-onedm-t2trg-sdf-00)
- Make sure the specification leads to interoperable implementations
- Identify gaps in:
 - Functionality (e.g., more complex data models)
 - Stability of normative references
 - Usability (from both OneDM process and implementers' point of view)
- Profit

So why standardize this now?

- OneDM completed a usable input document (SDF 1.0, Good enough to attract ~ 200 model submissions)
- OneDM is willing to transfer change control to IETF
- Missing features will need to be added, within months.
- *Models not yet cast in stone, we can still change SDF!*

Why standardize at all?

- OneDM contributors need stable, well-defined format specification
- OneDM needs stable basis for its model harmonization efforts
- Tools implementers need a stable, well-defined format specification

Why standardize in IETF

- IETF has a vendor-neutral process that tends to result in high-quality specifications
- Ecosystem SDOs are used to base their work on IETF specifications; they really trust the IETF to do the job right
- IETF has some experience with domain specific data modeling (area-of-application oriented)

What would an ASDF WG do

- Focus on SDF specification (only deliverable)
- Ensure that normative dependencies are stable, or customize them for inclusion in SDF specification
- Work with OneDM, IoT data model SDOs, and IoT vendors
- Deliver SDF format specification RFC (standards-track)

Clarifying questions

Notes from the ecosystems

OMA (DMSE, IPSO) perspective

Alan Soloway, OMA Board of Directors



LIAISON STATEMENT

Title: Endorsement of work in OneDM liaison group Public Confidential LS¹
Date: 17 June 2020
To: OCF – One Data Model Liaison Group
Source: DMSE WG & IPSO WG of the Open Mobile Alliance
Send Replies to: OMA-LIAISON@mail.openmobilealliance.org
Contact(s): Hannes Tschofenig (DMSE Chair)
Travis Shanahan (DMSE Vice-Chair)
Bahadir Danisik (DMSE Vice-Chair)
Matthew Gillmore (IPSO Chair)
Scott Potter (IPSO Vice-Chair)
Jaime Jimenez (IPSO Vice-Chair)
Attachments: n/a

1 Statement

OMA SpecWorks acknowledges that achieving interoperability across ecosystems is key for accelerating the adoption and deployment of successful IoT solutions and endorses the work done in the One Data Model liaison group to address the challenges for interoperability. OMA SpecWorks has already contributed all the objects created in the IPSO Working Group to the OneDM experimental playground and plans to submit future versions of the IPSO objects as stable OneDM definitions. We are looking forward to continue working with the OneDM liaison group to further facilitate interoperability of OMA SpecWorks technologies with other IoT ecosystems

2 Requested Action(s)

- “OMA SpecWorks acknowledges that achieving interoperability across ecosystems is **key for accelerating the adoption** and deployment of successful IoT solutions and endorses the work done in the One Data Model liaison group to address the challenges for interoperability. OMA SpecWorks **has already contributed** all the objects created in the IPSO Working Group to the OneDM experimental playground and plans to submit future versions of the IPSO objects as stable OneDM definitions. We are looking forward to **continue working** with the OneDM liaison group to further facilitate interoperability of OMA SpecWorks technologies with other IoT ecosystems.”
- Note that OMA SpecWorks has adopted the BSD 3-clause license for this.


```

<LWM2M xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="http://openmobilealliance.org/tech/profiles/LWM
2M.xsd">
  <Object ObjectType="MODefinition">
    <Name>Temperature</Name>
    <Description1>This IPSO object should be used with a
temperature sensor to report a temperature measurement. It also provides
resources for minimum/maximum measured values and the minimum/maximum range
that can be measured by the temperature sensor. An example measurement unit is
degrees Celsius.</Description1>
    <ObjectID>3303</ObjectID>
    <ObjectURN>urn:oma:lwm2m:ext:3303</ObjectURN>
    <LWM2MVersion>1.0</LWM2MVersion>
    <ObjectVersion>1.0</ObjectVersion>
    <MultipleInstances>Multiple</MultipleInstances>
    <Mandatory>Optional</Mandatory>
    <Resources>
      <Item ID="5700">
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        <Operations>R</Operations>
        <MultipleInstances>Single</MultipleInstances>
        <Mandatory>Mandatory</Mandatory>
        <Type>Float</Type>
        <RangeEnumeration></RangeEnumeration>
        <Units></Units>
        <Description>Last or Current Measured Value
from the Sensor.</Description>
      </Item>
      <Item ID="5601">
        <Name>Min Measured Value</Name>
        <Operations>R</Operations>
        <MultipleInstances>Single</MultipleInstances>
        <Mandatory>Optional</Mandatory>
        <Type>Float</Type>
        <RangeEnumeration></RangeEnumeration>
        <Units></Units>
        <Description>The minimum value measured by the
sensor since power ON or reset.</Description>
      </Item>
      <Item ID="5602">

```

```

{
  "info": {
    "title": "OMA Lwm2m Temperature (Object ID 3303)",
    "version": "2020-07-13",
    "copyright": "Copyright (c) 2018-2020 IPSO",
    "license": "https://github.com/one-data-model/oneDM/blob/master/LICENSE"
  },
  "sdfObject": {
    "Temperature": {
      "label": "Temperature",
      "description": "This IPSO object should be used with a temperature sensor to report a
temperature measurement. It also provides resources for minimum/maximum measured values and the
minimum/maximum range that can be measured by the temperature sensor. An example measurement
unit is degrees Celsius.",
      "sdfProperty": {
        "Sensor_Value": {
          "label": "Sensor Value",
          "description": "Last or Current Measured Value from the Sensor.",
          "writable": false,
          "type": "number"
        },
        "Min_Measured_Value": {
          "label": "Min Measured Value",
          "description": "The minimum value measured by the sensor since power ON or reset.",
          "writable": false,
          "type": "number"
        },
        "Max_Measured_Value": {
          "label": "Max Measured Value",
          "description": "The maximum value measured by the sensor since power ON or reset.",
          "writable": false,
          "type": "number"
        },
        "Min_Range_Value": {
          "label": "Min Range Value",
          "description": "The minimum value that can be measured by the sensor.",
          "writable": false,
          "type": "number"
        },
        "Max_Range_Value": {

```

Convert to SDF

- Copyright from file
- License from file

3303

LOAD

Convert to Lwm2m

Verify SDF Model

SDF File Name

LOAD

Zigbee Perspective

Michael Koster

- Board of Directors, Zigbee alliance
- Project CHIP Steering Committee
- Project CHIP Data Model Co-Lead



Zigbee Use Cases

- Provide a tool-friendly developer entry point for defining new ZCL Clusters, custom Clusters, and for using Cluster definitions in applications
- Public-facing format through which to publish the ZCL models under the BSD 3-Clause license and manage the broader public dissemination of the ZCL models
- Use SDF to converge ZCL models across projects, CHIP, Zigbee Pro, and others as the Alliance grows
 - Provide a consistent abstraction layer from which XML code for different stacks can be generated

OCF perspective



- “The Open Connectivity Foundation acknowledges that achieving interoperability across ecosystems is key for accelerating the adoption and deployment of successful IoT solutions and hereby endorses the work done in the One Data Model liaison group to address the challenges for interoperability on data modeling work.”
- OCF has adopted the BSD 3-clause license to contribute models to oneDM.
- OCF create conversion tooling between OCF models and SDF

Wouter van der Beek

Technical Coordination Steering Committee Chair, Open Connectivity Foundation



Liaison Statement	
Title/Subject:	Endorsement of work in OneDM liaison group
Date:	14 July 2020
To:	onedm@iotliaison.org
Copy to:	N/A
In response to:	N/A
Send replies to:	staff@openconnectivity.org
List of attachments:	N/A

Dear OneDM group,

The Open Connectivity Foundation acknowledges that achieving interoperability across ecosystems is key for accelerating the adoption and deployment of successful IoT solutions and hereby endorses the work done in the One Data Model liaison group to address the challenges for interoperability on data modeling work.

Sincerely,

David McCall

President, Open Connectivity Foundation

Bluetooth perspective



In order to create smarter, more efficient buildings, it is imperative that different building systems such as lighting control and HVAC are able to communicate with each other and share information, The SDF effort represents a pragmatic, near term approach to bridge the gap between these domains and enable smart buildings to realize their full potential.

Bluetooth members have been working on contributing the SDF representations of the rich set of Bluetooth mesh models to OneDM.

Szymon Slupik

Chair of the Bluetooth SIG Mesh Working Group

CTO of Silvair

Vendor view: SmartThings

Michael Koster

- Principal Research Engineer, SmartThings
 - Leading SmartThings participation in IoT Industry Standards
 - Leading architecture and best practices for the SmartThings Capability Model, on which the cross-vendor interoperability of our platform is based



SmartThings Use Cases

- Device integration
 - Correctly model, in the platform, IoT devices from diverse sources
 - Automate the code generation and protocol adaptation for device drivers
- Capability Model
 - Supports a new service-and-API-based management system for abstract models that can be scaled and maintained
 - SDF is semantically aligned with the current Capability Model
- 3rd party API integration
 - Industry standard for describing the semantics of Capabilities for API integration and automation, using Swagger and WoT

Vendor view: Ericsson

Ari Keränen



Ericsson uses of SDF: reducing integration cost

- Provisioning different data sources to IoT platform
- Cross-ecosystem interoperability PoC using SDF:
LwM2M/IPSO <-> other protocols / data models
- Tools for model development and translation
<https://github.com/EricssonResearch/ipso-odm/>

Clarifying questions

the questions will be...

- DO WE HAVE AGREEMENT about the PLAN?
- DO WE HAVE ENERGY TO DO THIS?
- SHOULD THE IETF DO THIS?

Discussion

- Open Mic

Charter text

- (We are a non-WG-forming BOF, so **we don't discuss** this here today.)
- Will be in <https://github.com/one-data-model/ietf108/blob/master/charter.md>

Calling the questions

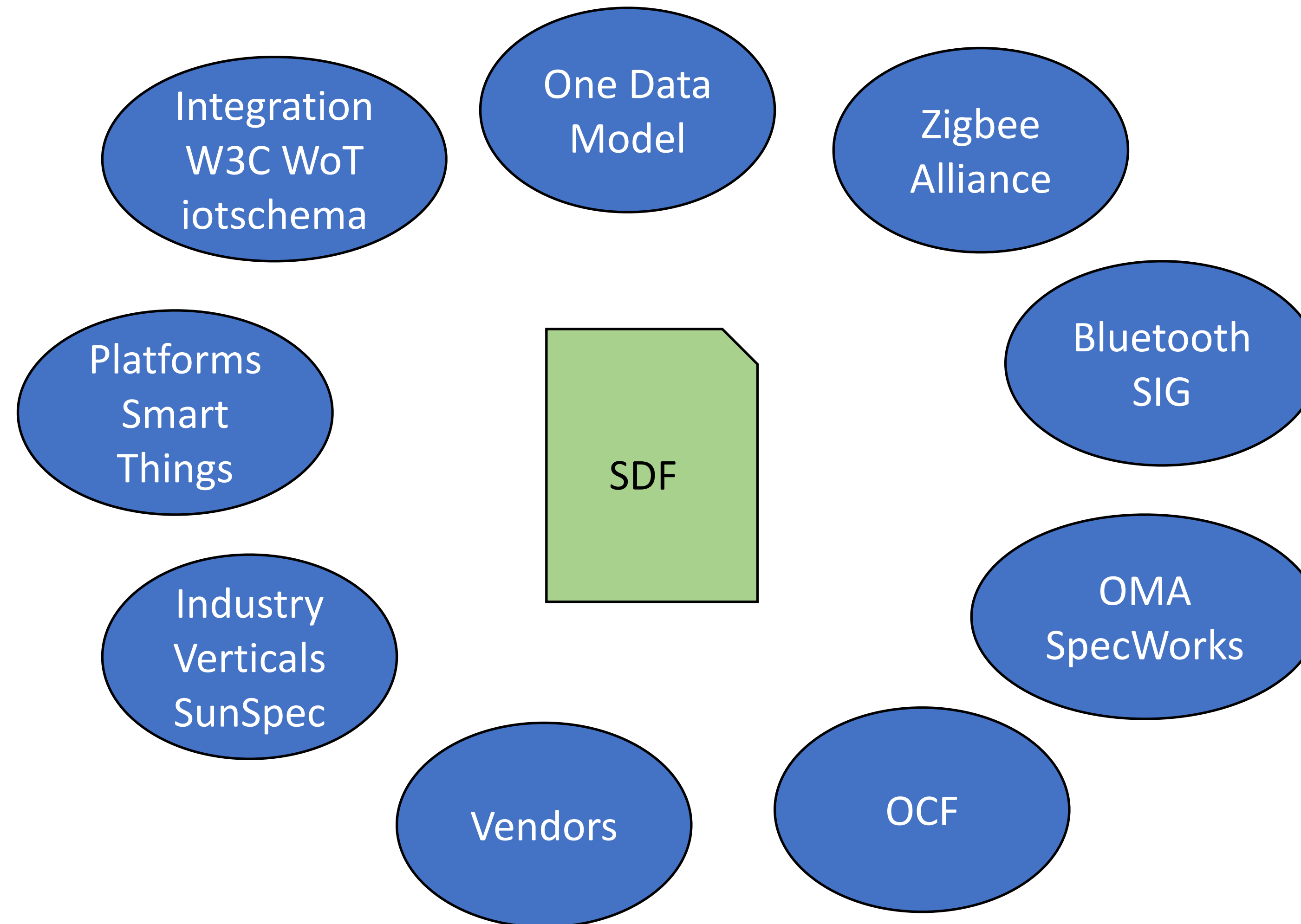
- DO WE HAVE AGREEMENT about the PLAN?
- DO WE HAVE ENERGY TO DO THIS?
- SHOULD THE IETF DO THIS?

Backup

W3C Web of Things integration

- Provide a vehicle for a vendor driven "vocabulary" of application types for annotation WoT Thing Description instances
 - Application vocabulary is out of scope for the W3C WoT Charter
 - SDF is purpose-built by device vendors and SDOs to describe application types
- Thing Description provides a Protocol Binding language for SDF-defined semantics
 - SDF is intentionally protocol-agnostic, and contains no network protocol vocabulary features, nor protocol binding hooks per se, and only describes high level data types
 - Thing Description focuses on describing the data schemas used in communication and integrating diverse network protocols

SDF Ecosystem – Common IoT Modeling Format across Industry



Governance of SDF vs. Content

