Schema.org Extensions for IoT (iotschema)

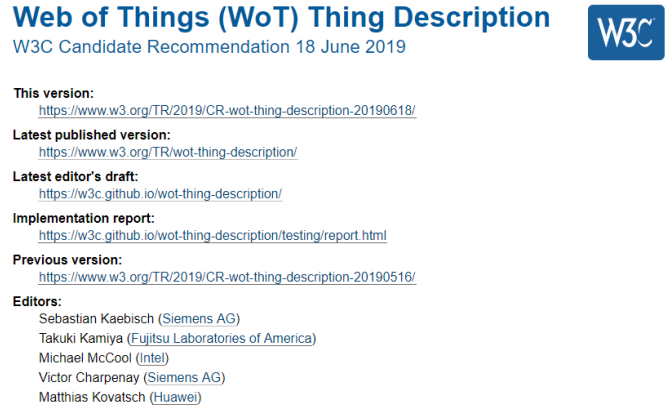
Darko Anicic, Michael Koster

Data Models and Semantic Interoperability

IoT Week, Aarhus, Denmark - 20.06.2019

Data models for IoT

- Web of Things
  Thing Description
  W3C Candidate Recommendation



Web of Things (WoT) Thing Description
W3C Candidate Recommendation 18 June 2019

This version:
https://www.w3.org/TR/2019/CR-wot-thing-description-20190618/
Latest published version:
https://www.w3.org/TR/wot-thing-description/
Latest editor's draft:
https://w3c.github.io/wot-thing-description/
Implementation report:
https://w3c.github.io/wot-thing-description/testing/report.html
Previous version:
https://www.w3.org/TR/2019/CR-wot-thing-description-20190516/
Editors:
Sebastian Kaebisch (Siemens AG)
Takuki Kamiya (Fujitsu Laboratories of America)
Michael McCool (Intel)
Victor Charpenay (Siemens AG)
Matthias Kovatsch (Huawei)

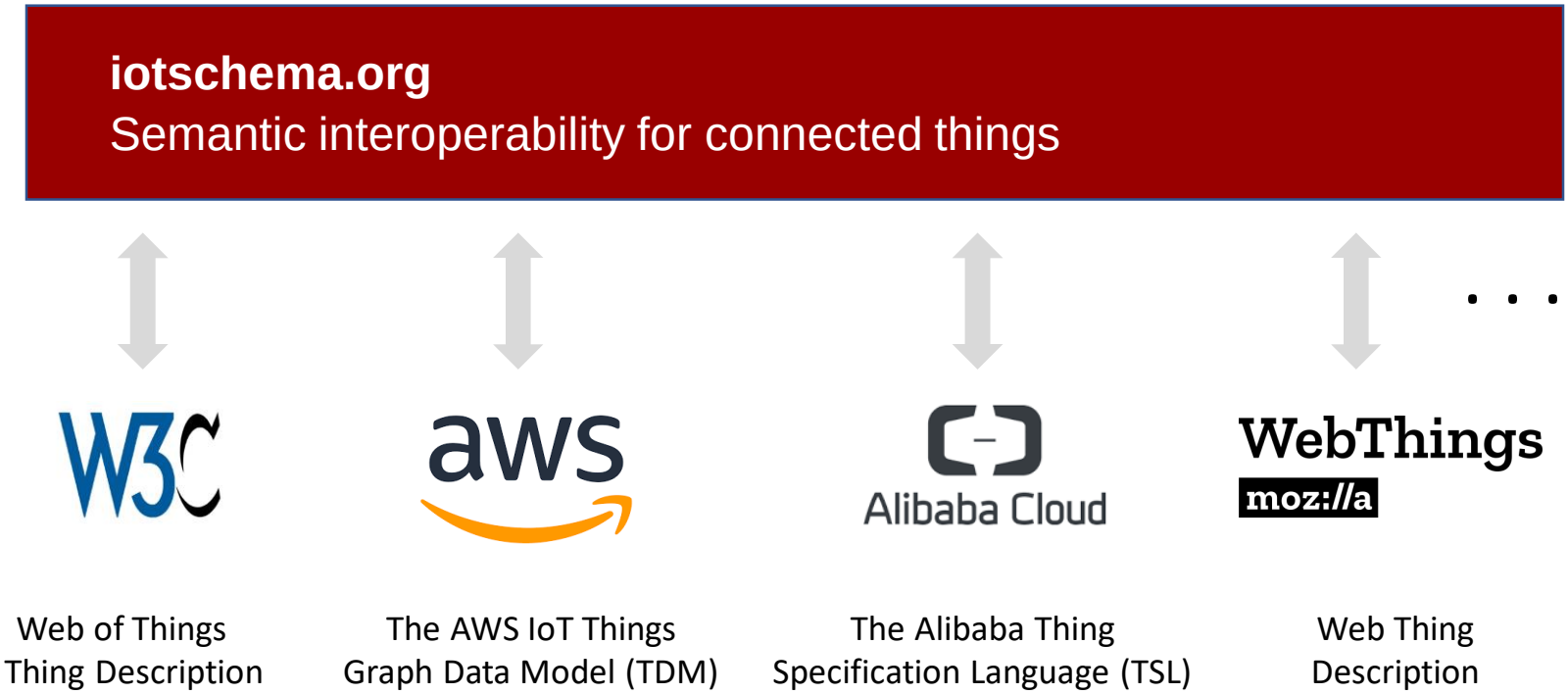
- Few other IoT ecosystems revolve around similar thing data models.

The AWS IoT Things Graph Data Model (TDM)

The Alibaba Thing Specification Language (TSL)

Web Thing Description

Common semantic layer



What is iotschema ?

- An open, publicly available, repository of semantic definitions for connected things
- An extension of schema.org to enable descriptions of things in the physical world and their data
- A common set of tools and patterns, and a community process for contribution and publication of standardized definitions
- A way for domain experts to easily create semantic definitions that are relevant to their application domain

What is iotschema (2) ?

- A layer to bridge between device ecosystems and Semantic Web technology
- Property and relation types to enable reuse of existing ontologies and definitions
  - SSN, SOSA, SAREF, QUDT
  - Property types for e.g. Feature of Interest
- Annotation vocabulary for WoT Thing Description
  - Common definitions for application-specific Events, Actions, and Properties

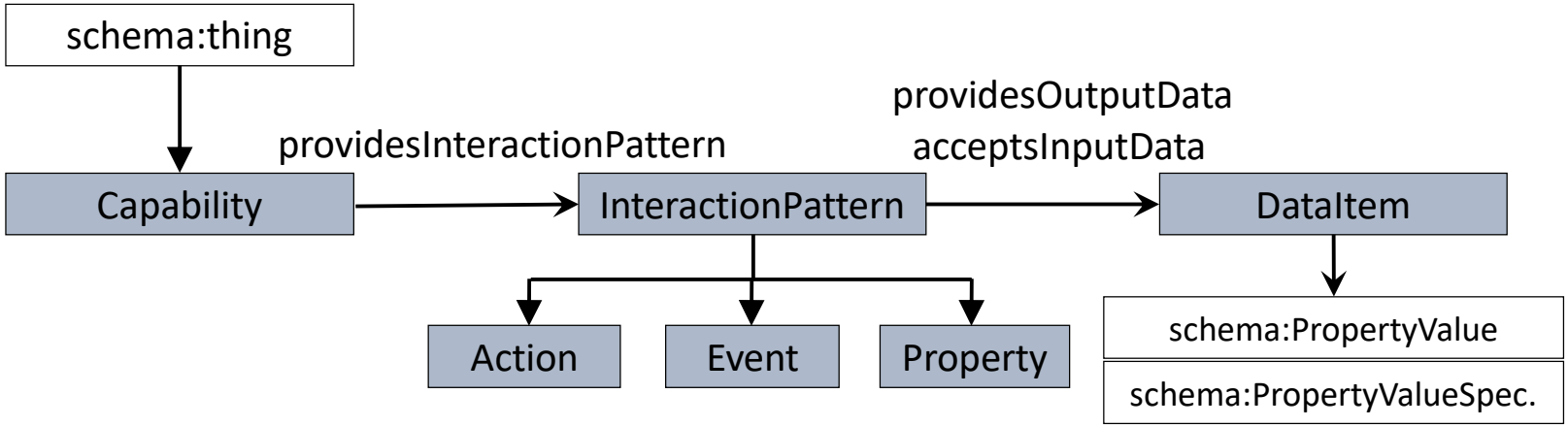
Who is iotschema for?

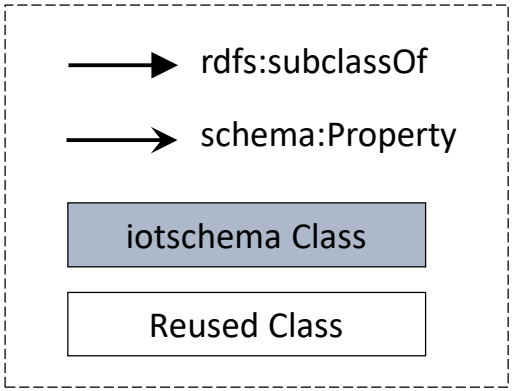
- **IoT platform providers** will use iotschema to make it easy for third party applications to use the platform
- **Device vendors** and SDOs will use iotschema to publish protocol-neutral definitions of their devices to enable web scale adoption
- **Domain experts** will use iotschema to create domain-specific languages for connected things and their applications
- **Application providers** will use iotschema to make their applications portable across platforms

iotschema: Semantic categories

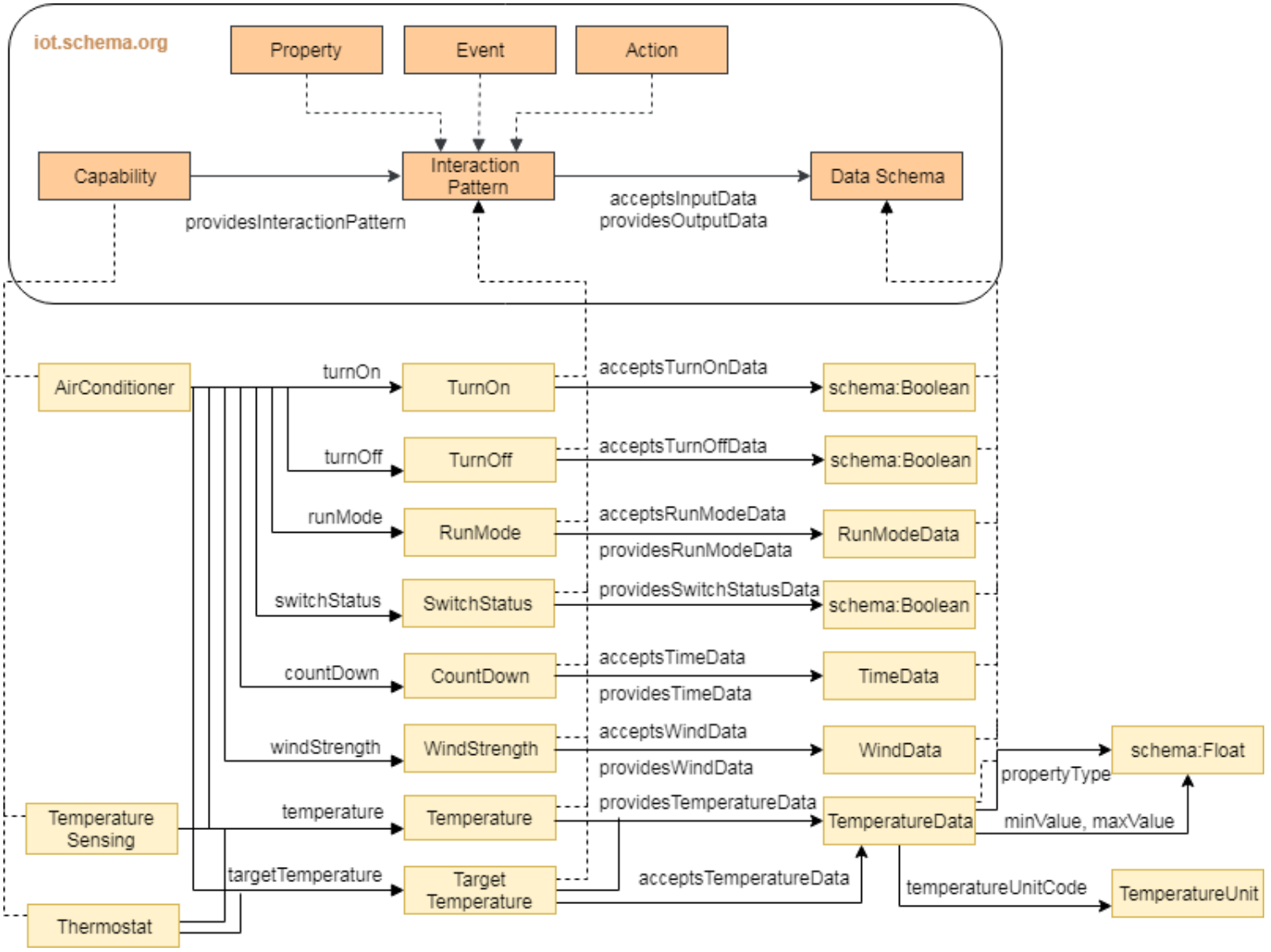
- **iotschema** semantic definitions consist of three categories, or classes, that describe a measurement or actuation, of some physical property or item
  - A **Capability** describes the smallest practical compose-able unit of functionality (measurement an/or actuation),e.g the temperature of something, or the brightness of a light bulb. A Capability has some related Interactions.
  - An **Interaction (Event, Action, or Property)** describes an affordance to the capability, which may be to read or write a value, or perform a complex action.
  - **Data Item** descriptions contain data types, units, minimum and maximum values, and other information about the data model, for example a shape or schema

iotschema: Capability pattern

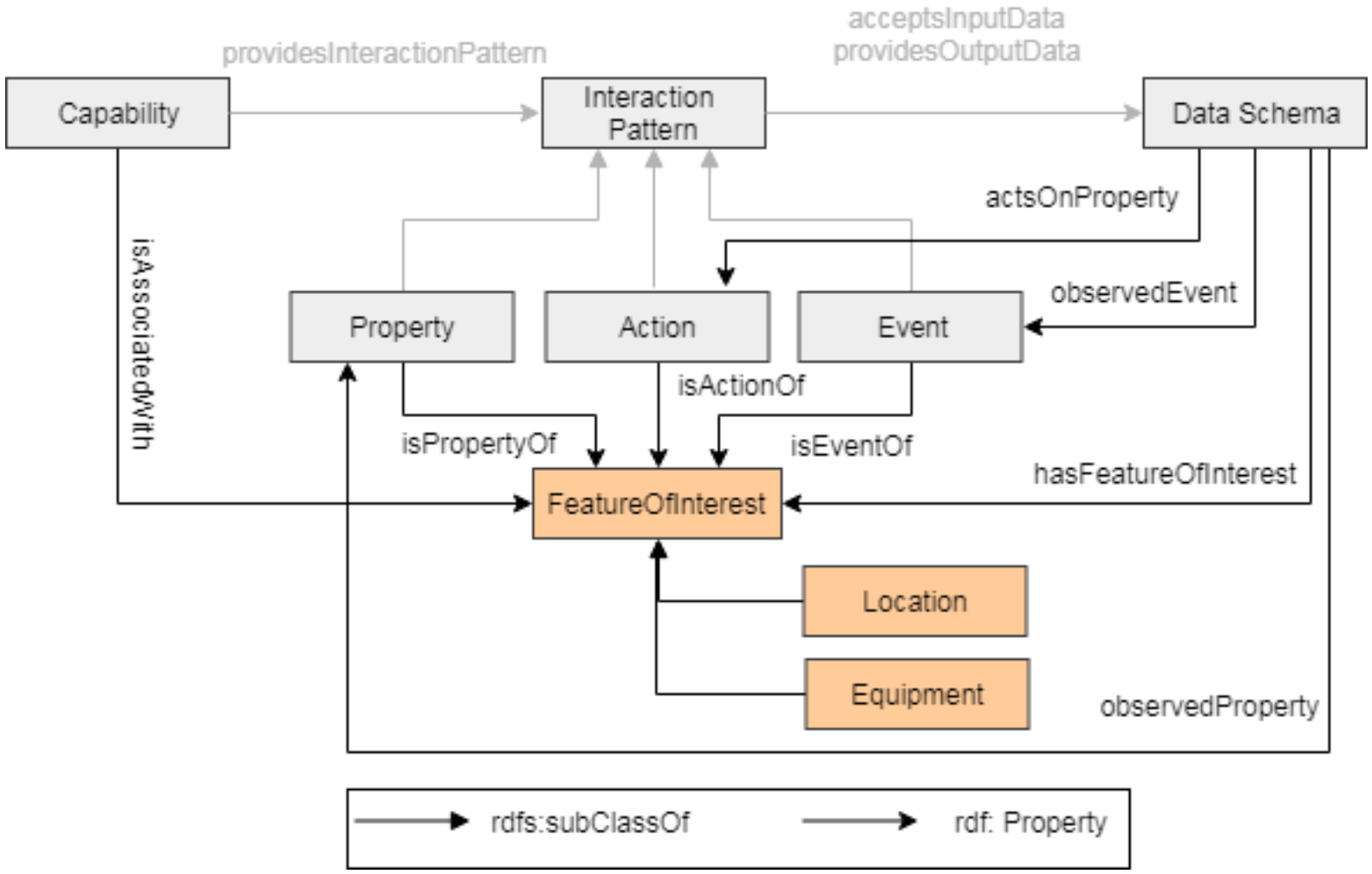




iotschema: Example



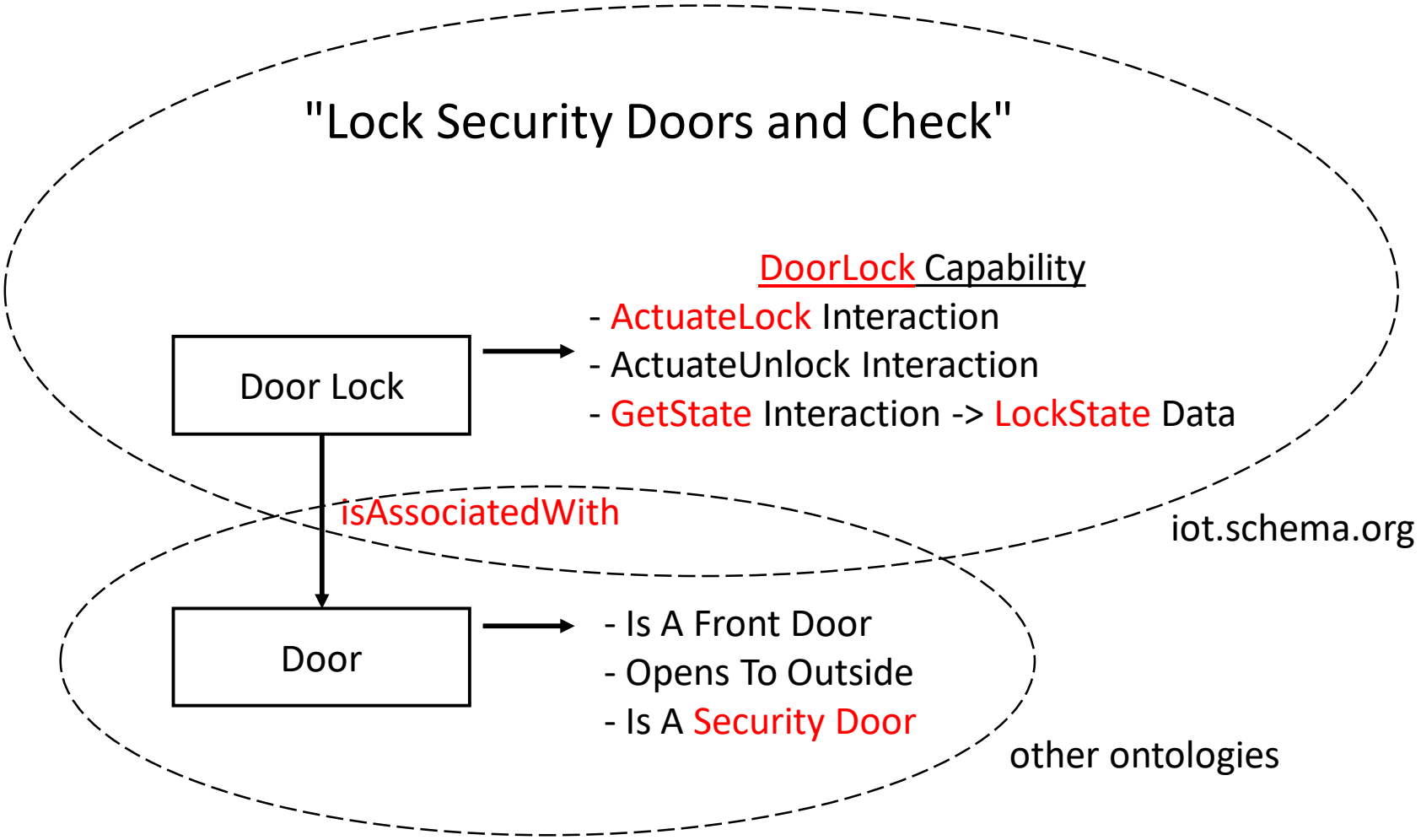
iotschema: Feature Of Interest pattern



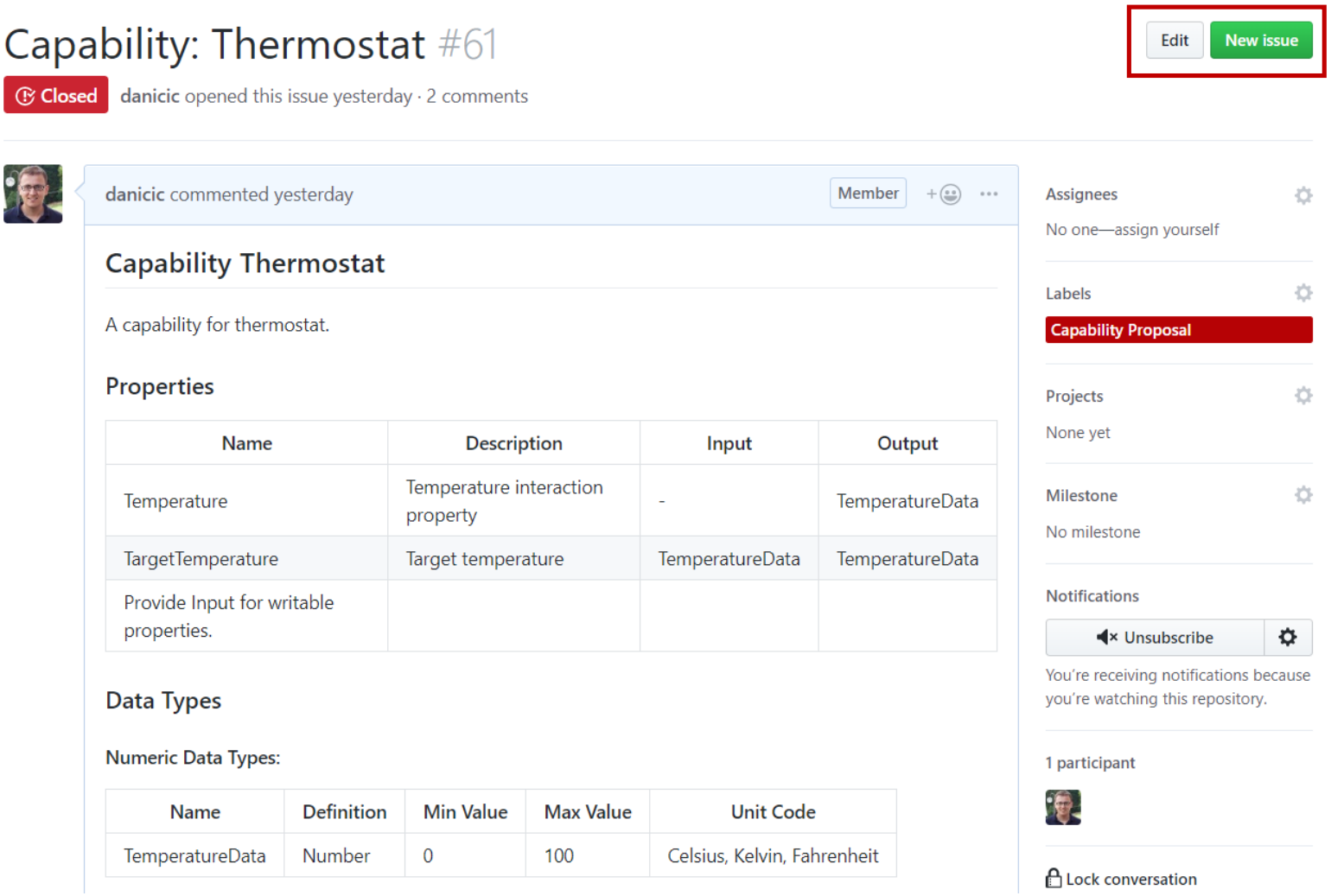
iotschema: Conceptual integration with other ontologies

- Feature of Interest concepts and property types to describe location, equipment, or other classifiers
- For example, BrickSchema definitions from Haystack
- Quantity and Units constraints can use QUDT concepts and appropriate identifiers
- SSN, SOSA, SAREF concepts can extend a definition
- W3C Linked Data Working Group

Connect things to the real world



How to contribute to iotschema?



Capability: Thermostat #61

Edit | New issue

Closed danicic opened this issue yesterday · 2 comments

danicic commented yesterday — Member

Capability Thermostat

A capability for thermostat.

Properties

Name	Description	Input	Output
Temperature	Temperature interaction property	-	TemperatureData
TargetTemperature	Target temperature	TemperatureData	TemperatureData
Provide Input for writable properties.			

Data Types

Numeric Data Types:

Name	Definition	Min Value	Max Value	Unit Code
TemperatureData	Number	0	100	Celsius, Kelvin, Fahrenheit

Assignees
No one—assign yourself

Labels
Capability Proposal

Projects
None yet

Milestone
No milestone

Notifications
Unsubscribe
You're receiving notifications because you're watching this repository.

1 participant

Lock conversation

https://github.com/iot-schema-collab/iotschema/tree/master/incoming

Status

- Monthly Teleconferences since mid-2017
- Examples of Definitions in a Github repository
- FoI annotation examples are also in the repo
- Prototypes tested at W3C Web of Things Plugfests and WISHI/IETF Hackathons from mid 2017
- Contributors are ready to begin submitting definitions
- Next steps are to build out tools and processes
- W3C Community Group

Current members

W3C CG: Schema.org Extensions for IoT

UNIVERSIDAD
POLITÉCNICA
DE MADRID

ERICSSON

iotschema: Resources

- W3C Community Group:

  The Schema Extensions For IoT

- https://www.w3.org/community/iotschema/

- GitHub repository:

- https://github.com/iot-schema-collab/iotschema

  Teleconferences:

- https://github.com/iot-schema-collab/teleconferences

  Contributions:

- https://github.com/iot-schema-collab/iotschema

  Charter:

- https://github.com/iot-schema-collab/ws-charter

- Web site:

  Current location

- http://iotschema.org/docs/full.html

  Future location

- http://iot.schema.org

- Tools:

  iotschema for Node-RED

- https://github.com/iot-schema-collab/iotschema-node-red

iotschema for Node-RED

Recipe-based applications

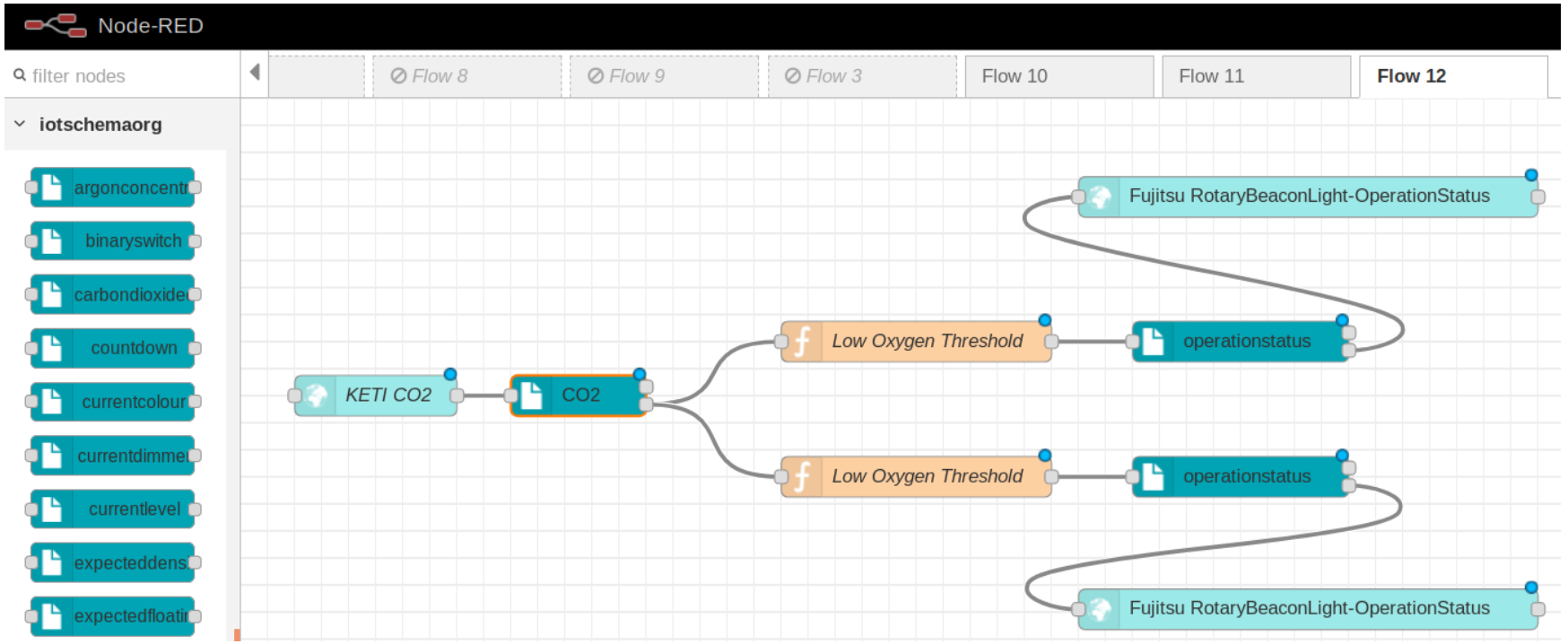
iotschema for Node-RED

Recipe-based applications

- iotschema embedded in Node-RED tool
  - Enables an easy configuration of things using iotschema definitions
- Easies the use of semantics for IoT developers
  - No need for a developer to know RDF(S), JSON-LD, RDF Shapes ...
- Simplify creation of applications with W3C WoT
  - Avoids translations of serializations formats, data types, units ...
- Demonstrates semantic discovery and processing
  - Integrates WoT Thing Directory

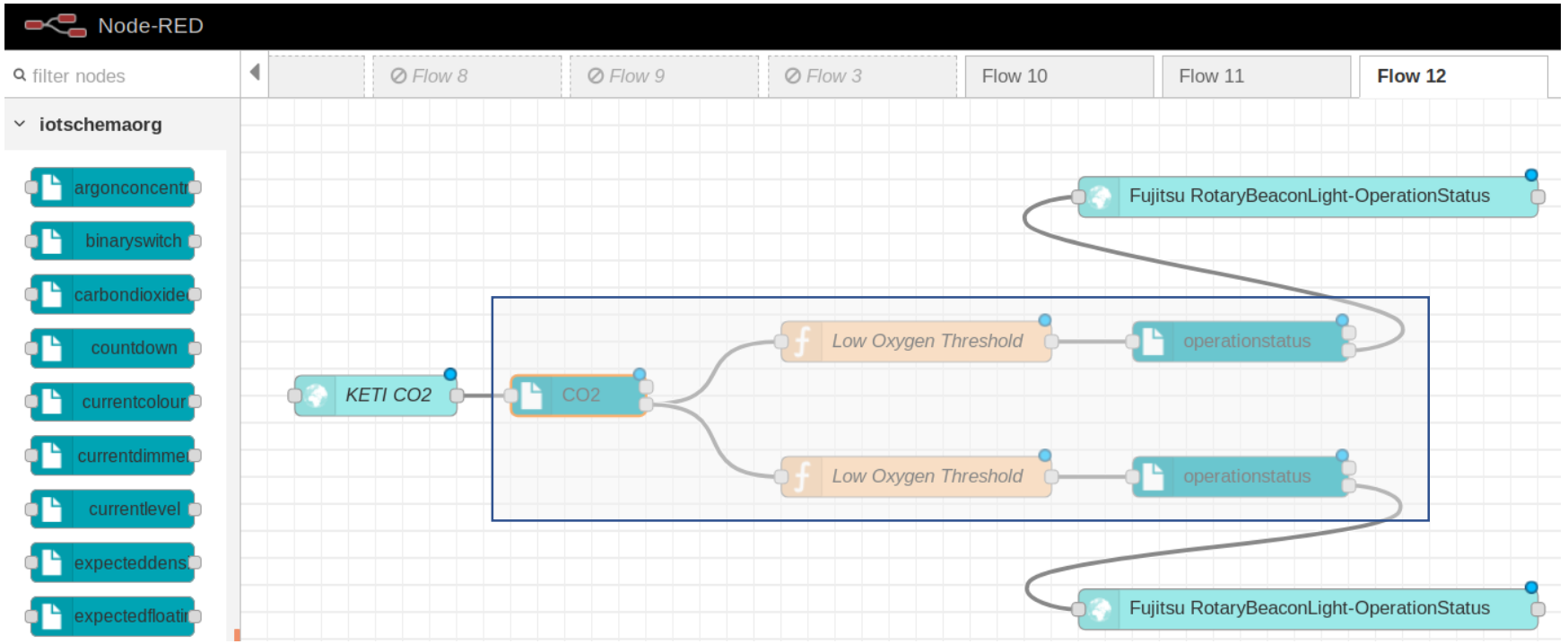
Example: Controlling Carbon Dioxide

Node-RED Application with W3C WoT Things

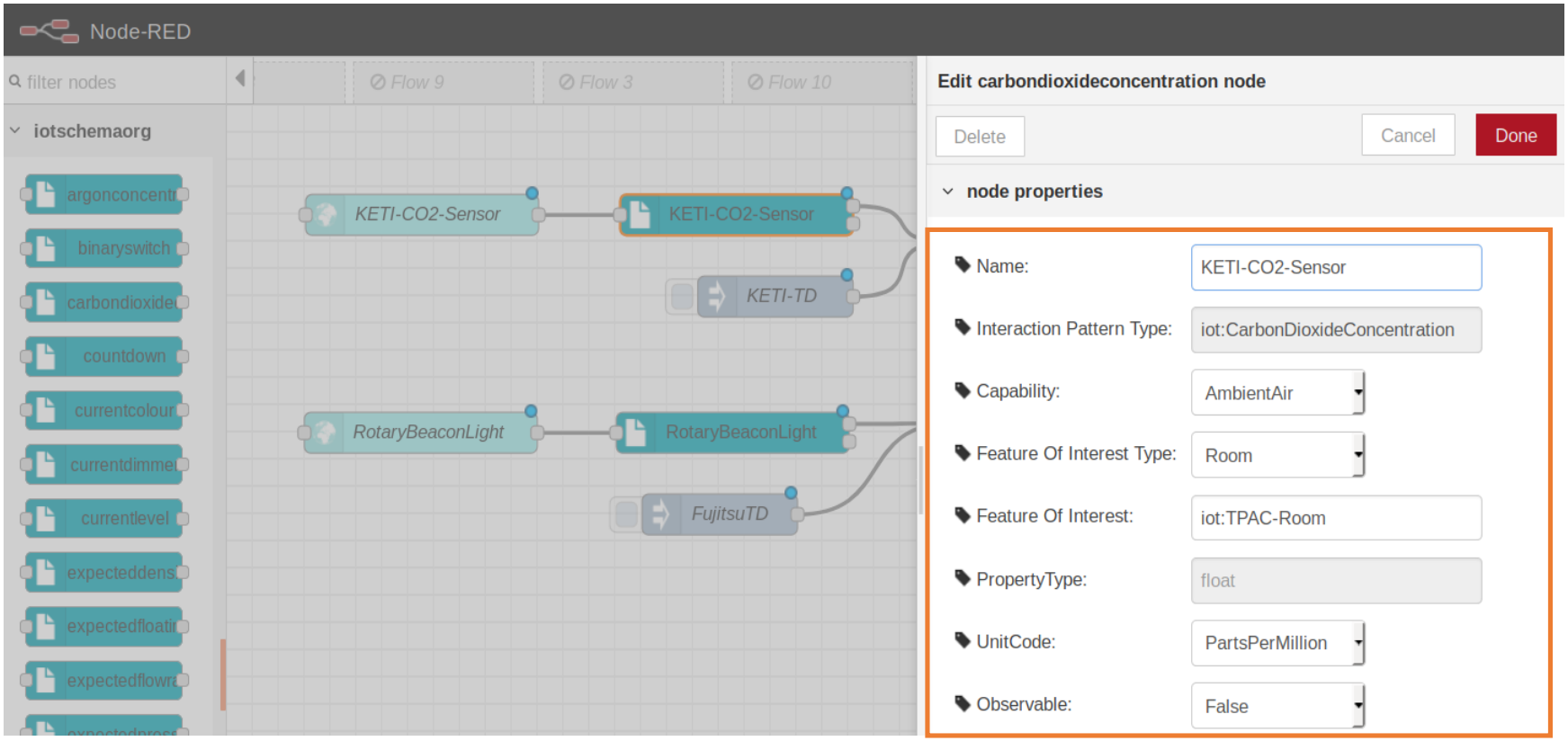


Example: Controlling Carbon Dioxide

Node-RED Application with W3C WoT Things

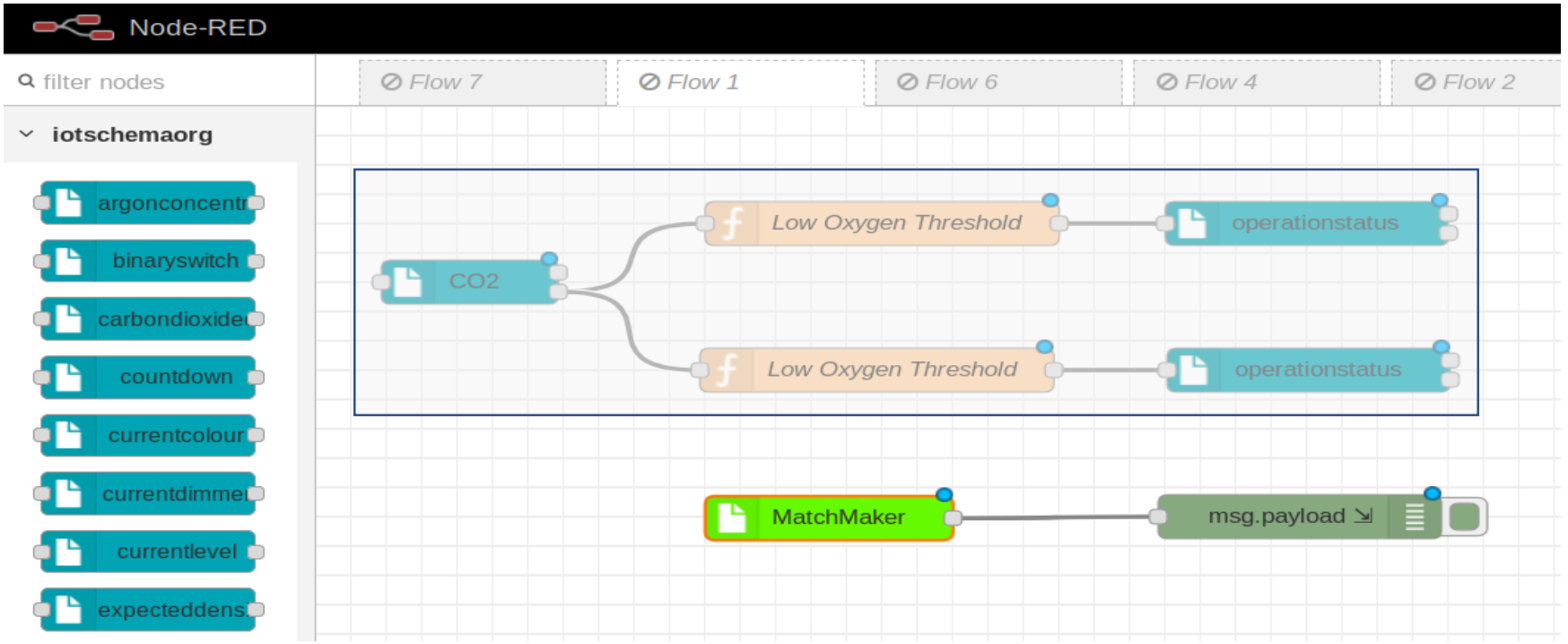


iotschema: Semantic Mark-Up for W3C WoT Thing Description



Semantic Recipe

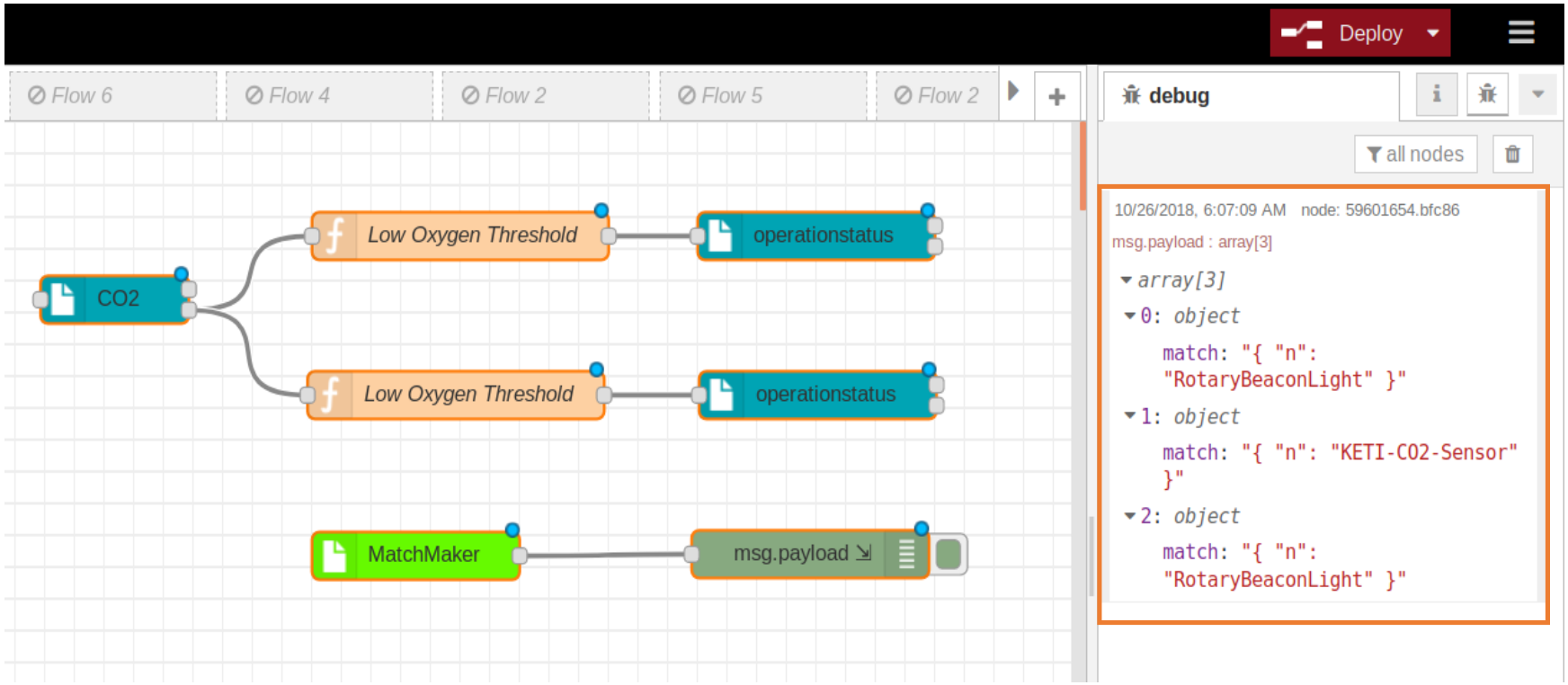
Reusable Flow Template



MatchMaker:

- finds Things that can implement the Recipe
- based on TD with iot.schema.org mark-ups

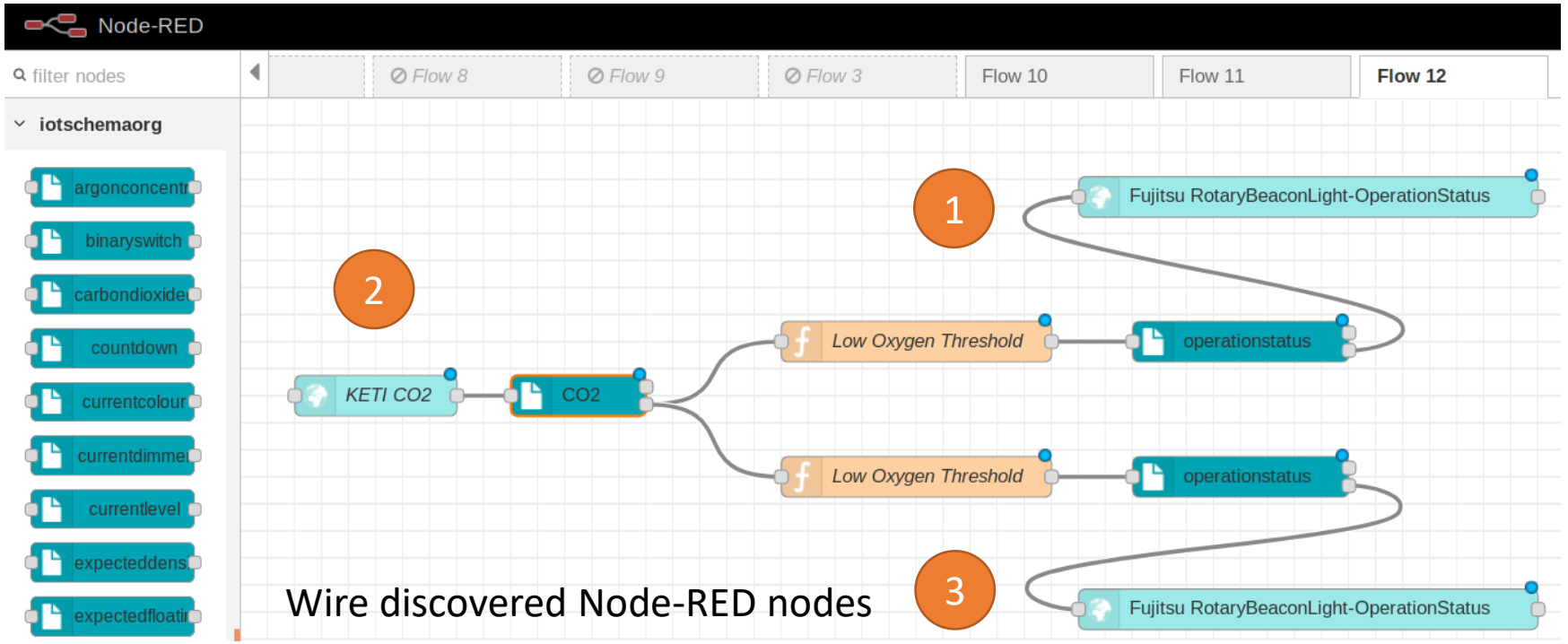
Semantic Discovery of Recipe Ingredients



Ingredients are Node-RED Nodes

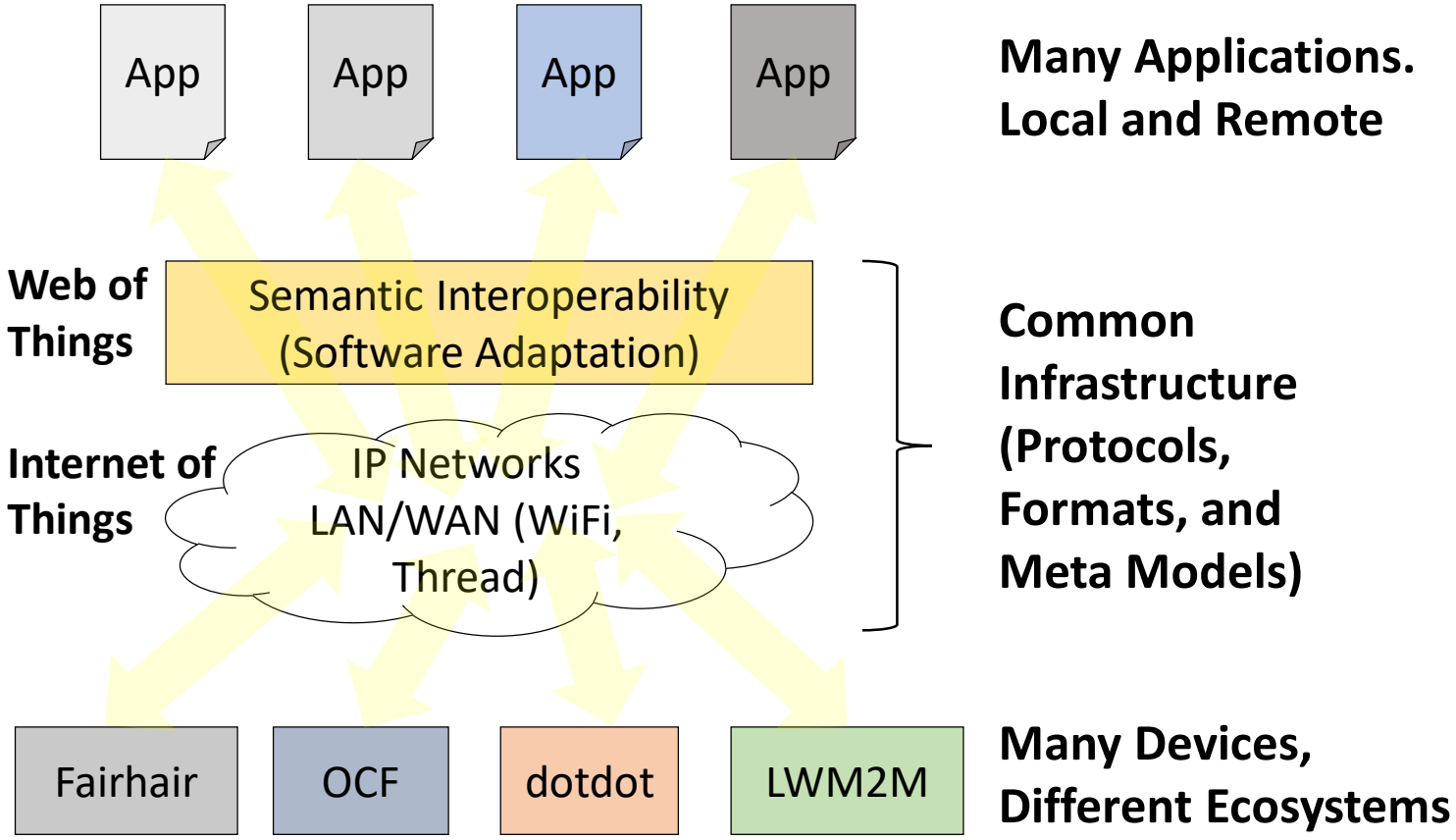
Example: Controlling Carbon Dioxide

Node-RED Application with W3C WoT Things

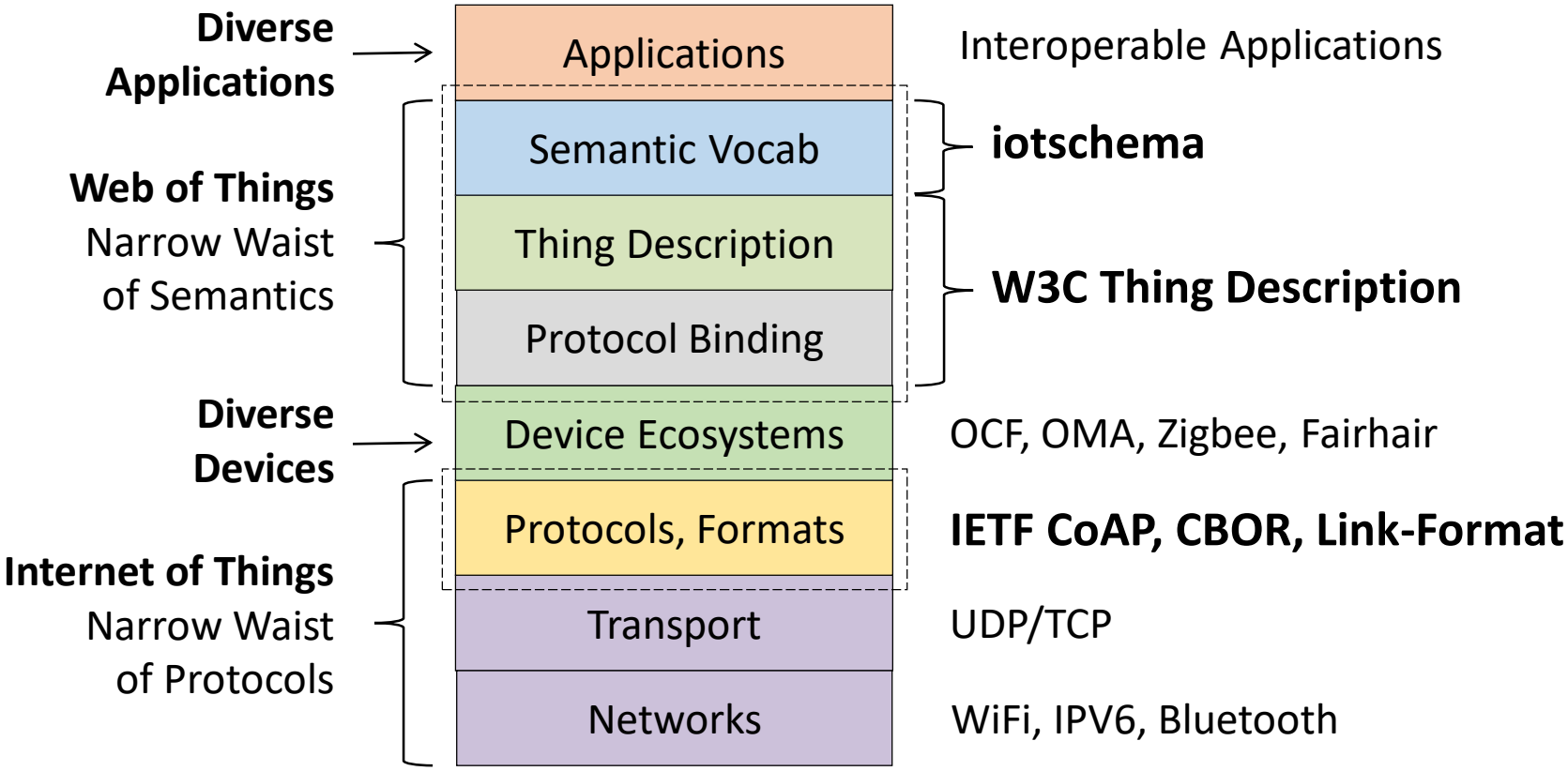


Back-Up

Narrow Waist in System Design



Diverse Devices and Applications, Common Protocols and Semantics



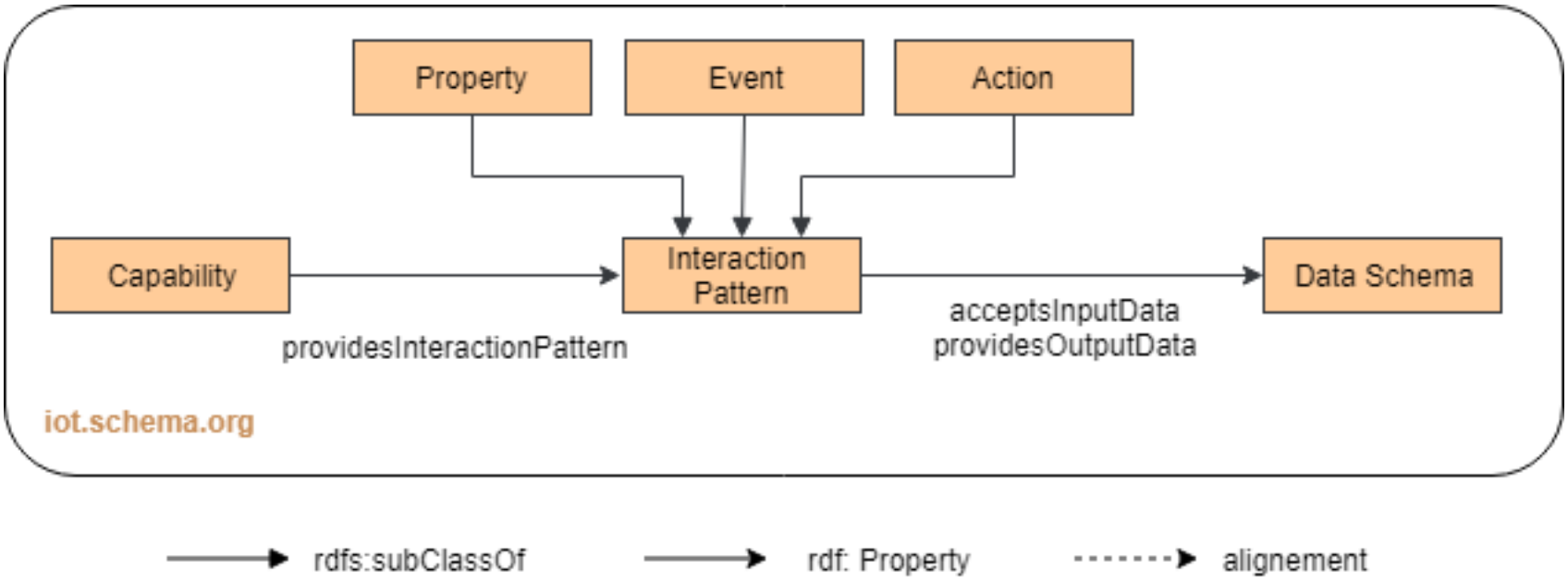
How is **iotschema** used?

- Annotation of Thing Descriptions (W3C Web of Things)
- Thing Descriptions have Action, Event, and Property Interaction definitions that can be annotated with **iotschema** Interaction class terms
- Thing Descriptions have DataSchema elements that can be annotated with **iotschema** Data Item class terms and constraints, such as data type, units
- Thing Description enables applications to interact with connected things independent of protocol and SDO profile

iotschema Definitions

- Semantic definitions that follow the design patterns and interaction affordances of connected thongs
- Interoperable due to a set of static and dynamic semantic constraints
- Define a "Capability" that represents – typically – the smallest practical compose-able unit of functionality
- For example, a temperature sensor, or a door lock

Capability Model
iot.schema.org



Feature of Interest Integration

- **Features Of Interest** (FoI) describe the real-world targets of sensing and actuation
- Definitions may be developed in iotschema, or more likely will come from domain experts
  - GENIVI/VSS is a Specification for Automotive Features of Interest, called Branches, and actuation/measurement points, called Attributes and Signals
  - BrickSchema is an adaptation of Haystack that defines Features of Interest of buildings and actuation or measurement points
- **iotschema** defines relationships between Capabilities and Features of Interest to describe **connected physical systems**