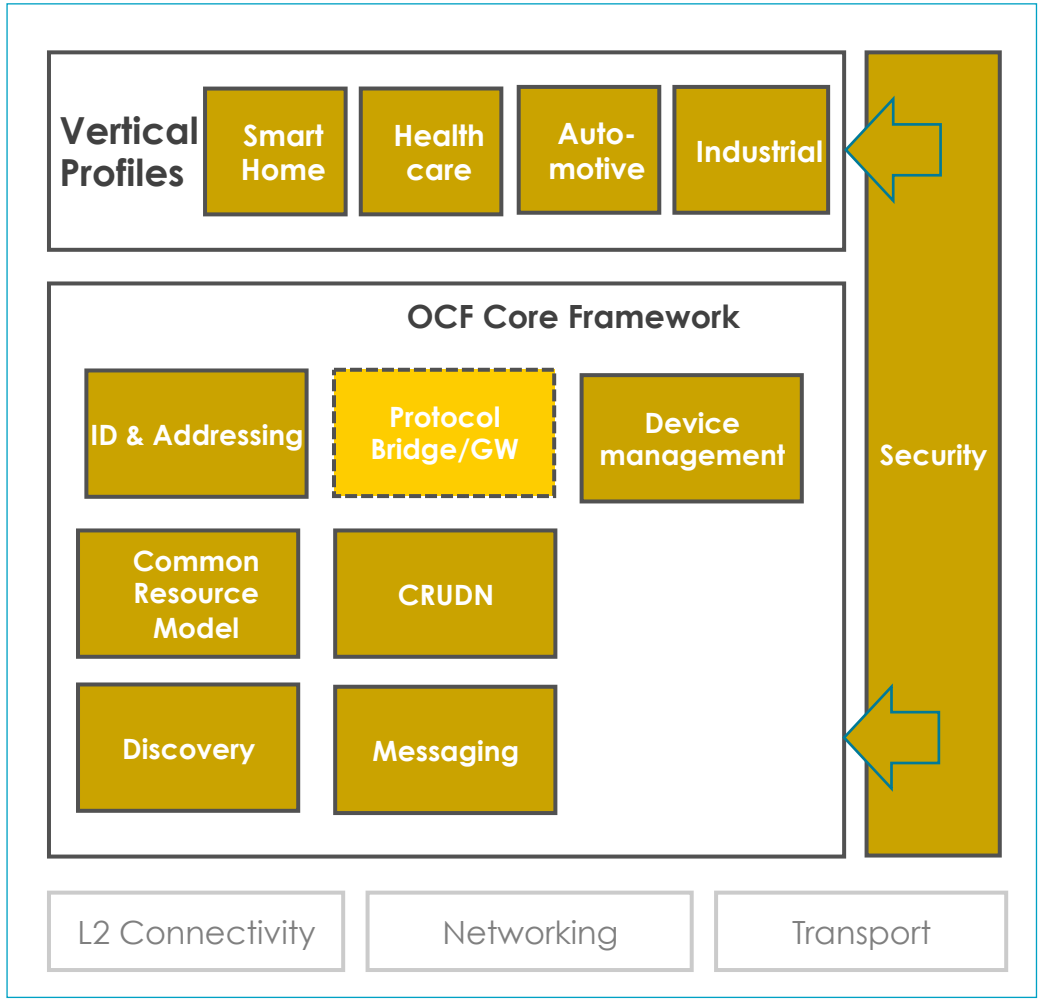
OPEN CONNECTIVITY FOUNDATION™

OCF SEMANTIC INTEROPERABILITY STATUS

June 2017

OCF Core Framework



① **Discovery:** Common method for device discovery (IETF CoRE)

② **Messaging:** Constrained device support as default (IETF CoAP) as well as protocol translation via bridges

③ **Common Resource Model:** Real world entities defined as data models (resources)

④ **CRUDN:** Simple Request/Response mechanism with Create, Retrieve, Update, Delete and Notify commands

⑤ **ID & Addressing:** OCF IDs and addressing for OCF entities (Devices, Clients, Servers, Resources)

⑥ **Protocol Bridge/GW**: Handled by the Bridging Spec with some implications on the Core

Security is fundamental to the OCF ecosystem and applies to all elements

OCF Standard Resource Types

- Total of 74 Resource Types defined as of OCF 1.0
  - All OCF Resource Type IDs are IANA registered: http://www.iana.org/assignments/core-parameters/core-parameters.xhtml
- Each resource type definition contains:
  - Unique identifier (rt)
  - List of mandatory and optional properties per resource
  - Identification of the default interface and other supported interfaces
  - List of supported methods (create, read, update, …)
  - List per method the JSON schema defining the supported payload

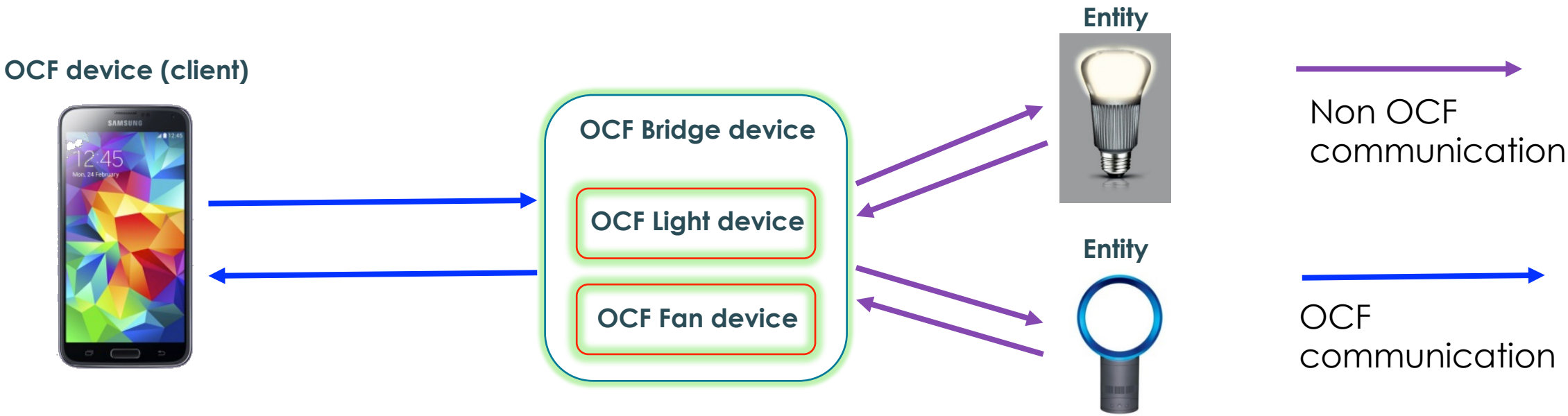
Resources are specified in RESTful API Modelling Language (RAML) and Swagger2.0

Vendor extensions

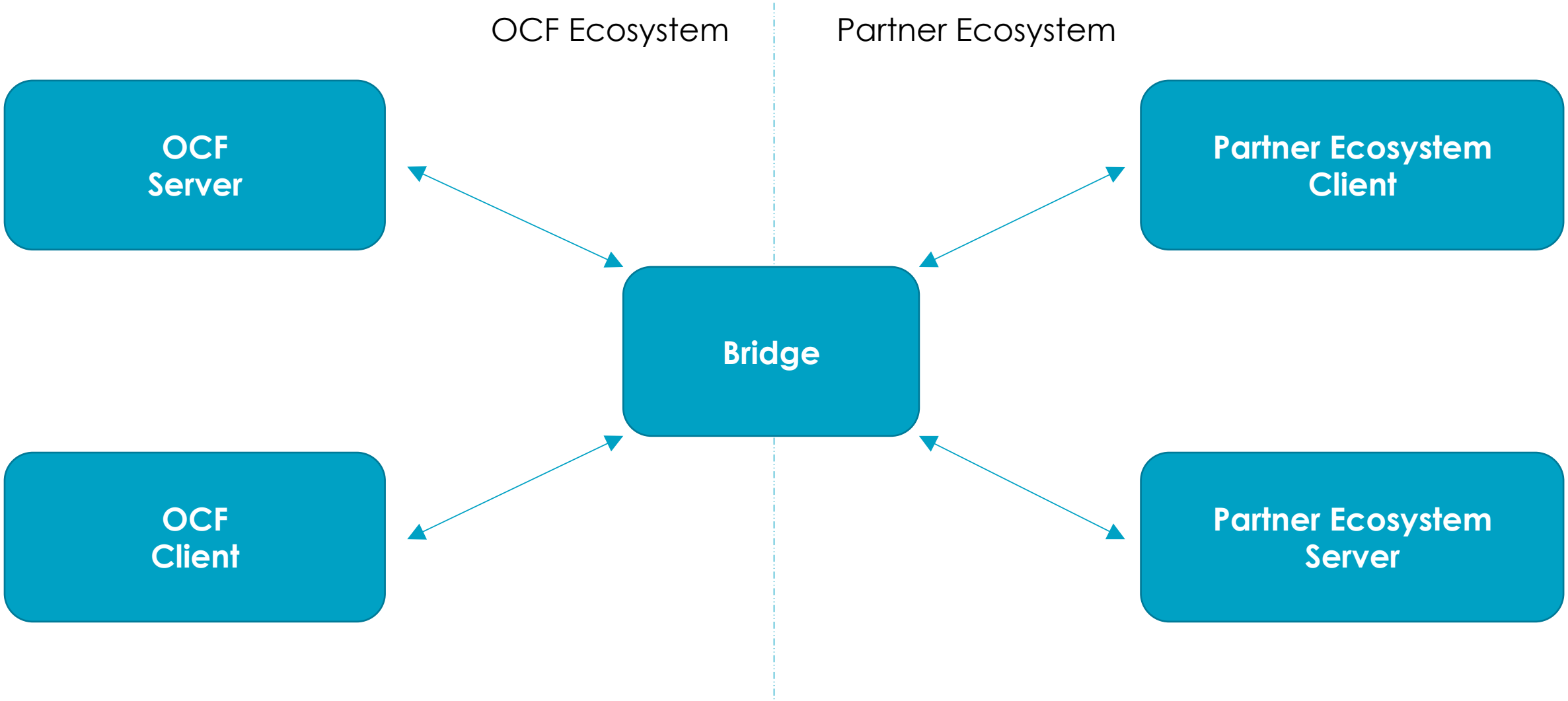
- Vendor is allowed to:
  - Create own defined (non-OCF standardized) resources
  - Create own defined (non-OCF standardized) device types
  - Extend existing devices with additional (not mandated) resources
    - With standardized resource types
    - With vendor defined resource types
- All vendor extensions follow an OCF-defined naming scheme

OCF Bridge – Definition

- An OCF Bridge is a device that represents one or more non-OCF devices (bridged devices) as virtual OCF devices on the OCF network.
- The bridged devices themselves are out of the scope of OCF.
- The only difference between a 'regular' OCF device and a virtual OCF device is that the latter is encapsulated in an OCF Bridge device.
- An OCF Bridge device itself is indicated on the network with an "rt" of "oic.d.bridge".



Bridging Concept – Bidirectional Operation



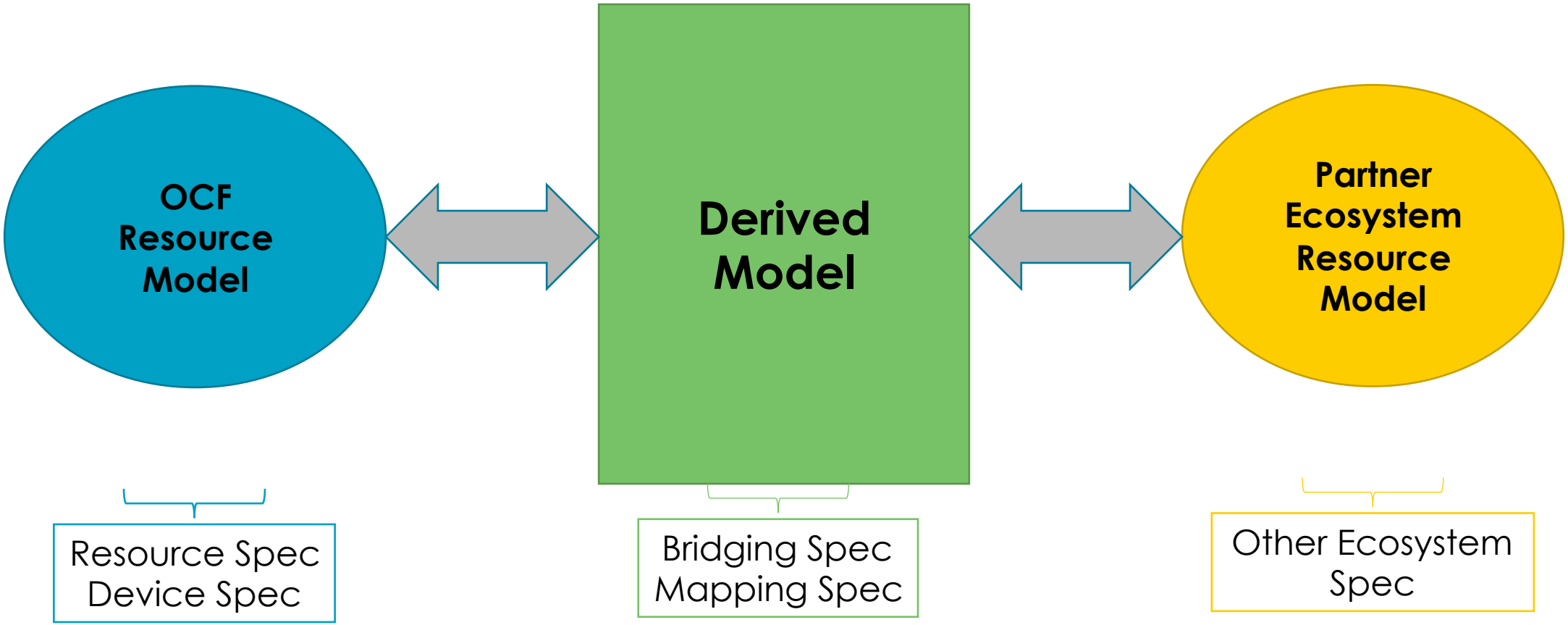
OCF Bridging Specification

- Specifies a framework for bi-directional translation between devices in OCF and non-OCF ecosystems.
- Specifies general requirements for translation between OCF and non-OCF ecosystems
  - Requirements for resource discovery, message translation, security, and handling of multiple bridges.
- Specifies specific requirements for translation between OCF and AllJoyn ecosystems (other projects in progress include UPnP, OneM2M, etc.)
  - Requirements for mapping core resources, propagating errors, and algorithmically translating custom resource types.
  - Refers to OCF to AllJoyn Mapping specification for translating well-known resource types.

Bridging Security

- OCF Bridge needs to be a trusted entity as it translates message payloads.
- OCF Bridge itself and all virtual devices that it exposes must be onboarded and provisioned for secure operation.
- Each virtual device exposed by the OCF Bridge must implement the security requirements of the ecosystem that it is connected to.
- Bridging specifies mechanisms to selectively block communications between the OCF Bridge and OCF devices and between the OCF Bridge and bridged devices. This fine-grained control enables an administrator to control communications across ecosystems that may not have similar security capabilities.

Bridging Concept – Data Model



Derived Models: e.g., AllJoyn

- Models the interworking between OCF and AllJoyn
- Makes use of derived model syntax as defined (with some small changes) in the OCF White Paper here: https://www.iab.org/wp-content/IAB-uploads/2016/03/OCF-Derived-Models-for-Interoperability-Between-IoT-Ecosystems_v2-examples.pdf
- Defines the mapping in terms of:
  - Device Type equivalency
  - Resource <-> Interface equivalency
  - Detailed Property by Property mapping on a per Interface Basis (Derived Models)
- Syntax currently assumes OCF is superset model; so any Device Types and Resource Types (as equivalents to AllJoyn interfaces) that were missing from OCF were defined in the equivalent OCF Specifications.

Derived Model Syntax

- Derived models use standard JSON schema syntax. Fundamentally, derived models provide a conversion mapping between OCF data models and the data models in AllJoyn.

```
"asa.environment.targethumidity": {
    "type": "object",
    "properties": {
      "targetvalue": {
        "type": "number",
        "description": "Measured value",
        "x-ocf-conversion": {
          "x-ocf-alias": "oic.r.humidity,oic.r.selectablelevels",
          "x-to-ocf": [
            "if minvalue != maxvalue, ocf.desiredhumidity = targetvalue;ocf.targetlevel = selectablehumiditylevels[0].",
            "if minvalue == maxvalue, ocf.targetlevel = targetvalue."
          ],
          "x-from-ocf": [
            "if x-ocf-alias == oic.r.humidity, targetvalue = desiredhumidity.",
            "if x-ocf-alias == oic.r.selectablelevels, targetvalue = targetlevel."
          ]
        }
      }
    }
```

AllJoyn Interface Name

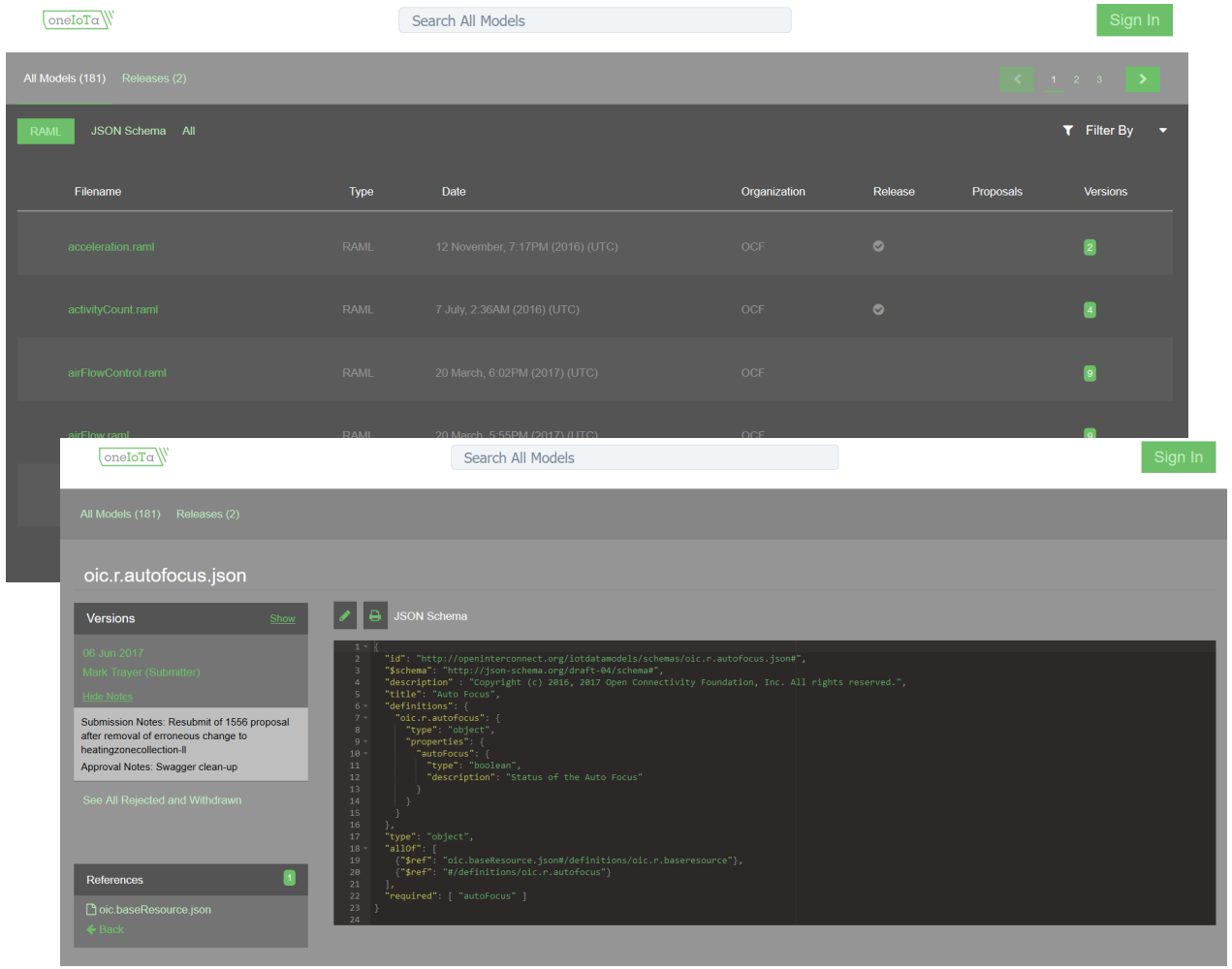
AllJoyn Property Name

OCF Equivalent Resource Type

To OCF Block

From OCF Block

OneIoTa Tool



- Web based (see: http://oneiota.org) development tool
- Supports RAML, JSON, and Swagger2.0 syntax
- Populated to date with all OCF Resources, Swagger2.0 versions of all such Resources, and OCF-AllJoyn derived models.
- Supports multiple organizations
  - Each submitting organization defines their own license terms

Introspection

- Why
  - On par with existing AllJoyn framework
- What
  - Device description is available on the network
  - Device description:
    - List all end points
    - Per end point
      - Which method are implemented
        - » Query parameters per method
        - » Payloads definitions (request and response)
- How
  - Put the data described in RAML and JSON on wire as a CBOR encoded Swagger2.0 document.
    - Describes the payload on JSON level
      - Property names
      - Type
      - range

Thank You

OCF Specifications:

- https://openconnectivity.org/developer/specifications

Resource Type Definitions

- Core Resources: https://github.com/openconnectivityfoundation
- Vertical Resources and Derived Models: https://oneiota.org/documents?filter%5Bmedia_type%5D=application%2Framl%2Byaml