Common Definition Format

One Data Model Liaison Group

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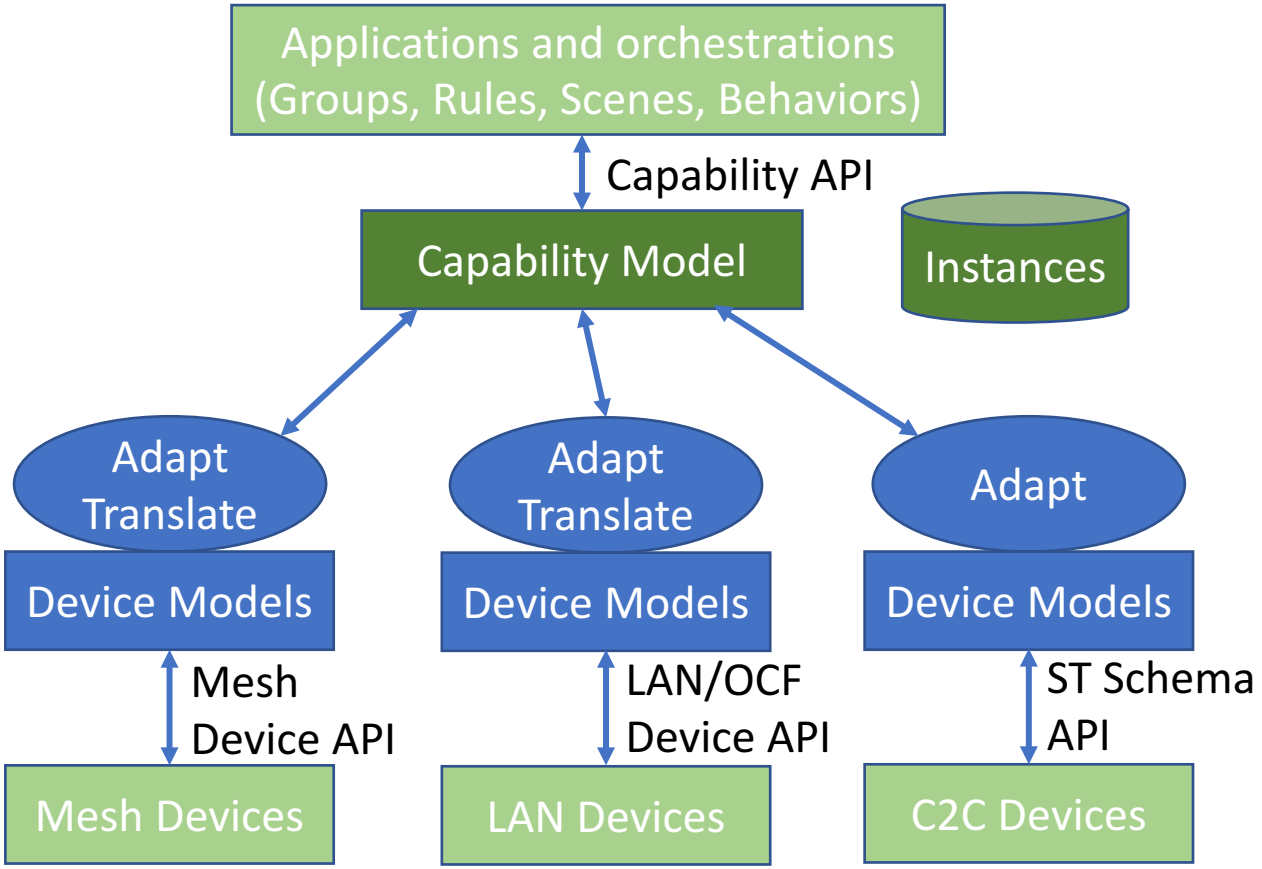
Common Definition Format

- SmartThings Capability Model and Examples
- Common Definition Format
- UML model
- RDF Examples
  - ZCL lighting clusters - mapped capabilities
  - OCF lighting RTs - mapped capabilities
  - ST lighting Capabilities - mapped capabilities
- OCF Protocol Binding

SmartThings Capability Model



SmartThings Capability Definitions

```
name: Switch
status: live
attributes:
  switch:
    schema:
      type: object
      additionalProperties: false
      properties:
        value:
          $ref: SwitchState
      required: ["value"]
    type: ENUM
    values:
      - 'off'
      - 'on'
    enumCommands:
      - command: 'on'
        value: 'on'
      - command: 'off'
        value: 'off'
commands:
  'off': arguments: []
  'on': arguments: []
public: true
id: switch
ocfResourceType: x.com.st.powerswitch
version: 1
```

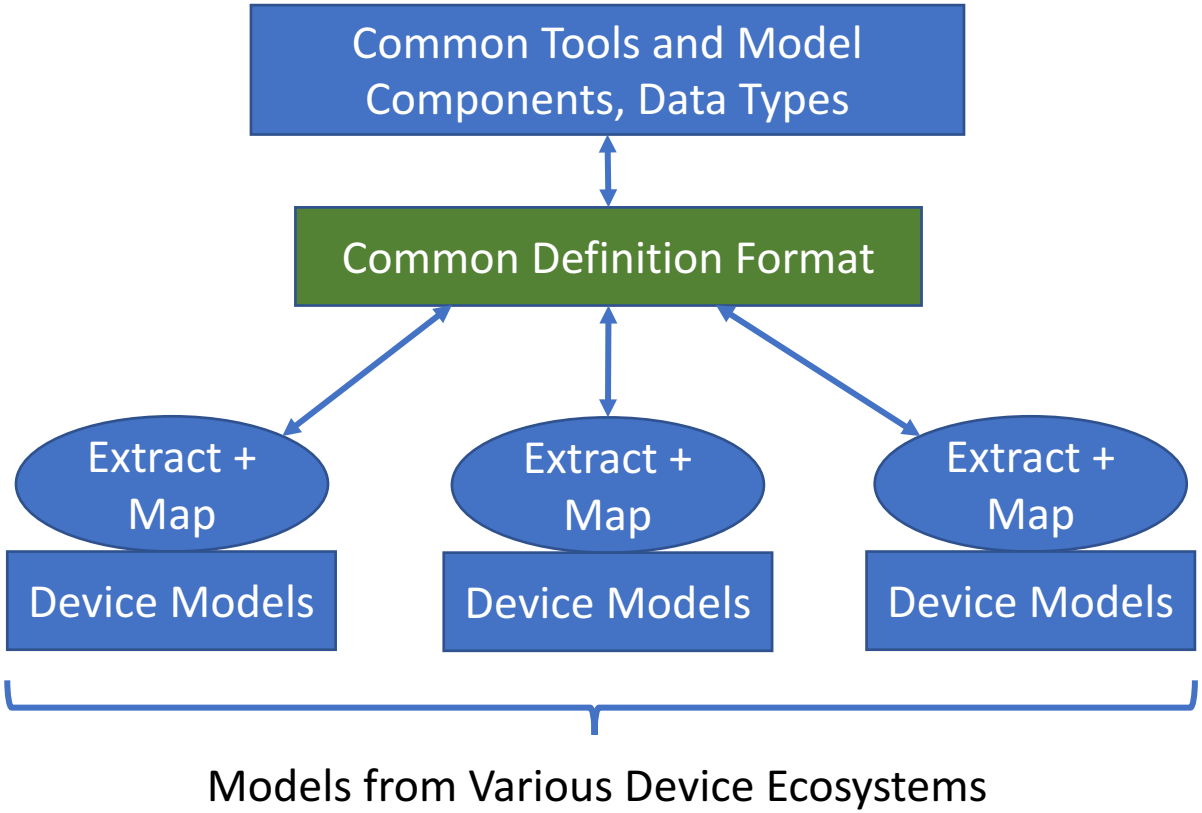
```
name: Switch Level
status: live
attributes:
  level:
    schema:
      $ref: IntegerPercent
    type: NUMBER
    setter: setLevel
commands:
  setLevel:
    arguments:
    - name: level
      schema:
        type: integer
        minimum: 0
        maximum: 100
      type: NUMBER
      required: true
    - name: rate
      schema:
        $ref: PositiveInteger
      type: NUMBER
      required: false
public: true
id: switchLevel
ocfResourceType: oic.r.light.dimming
version: 1
```

SmartThings DataType Definitions

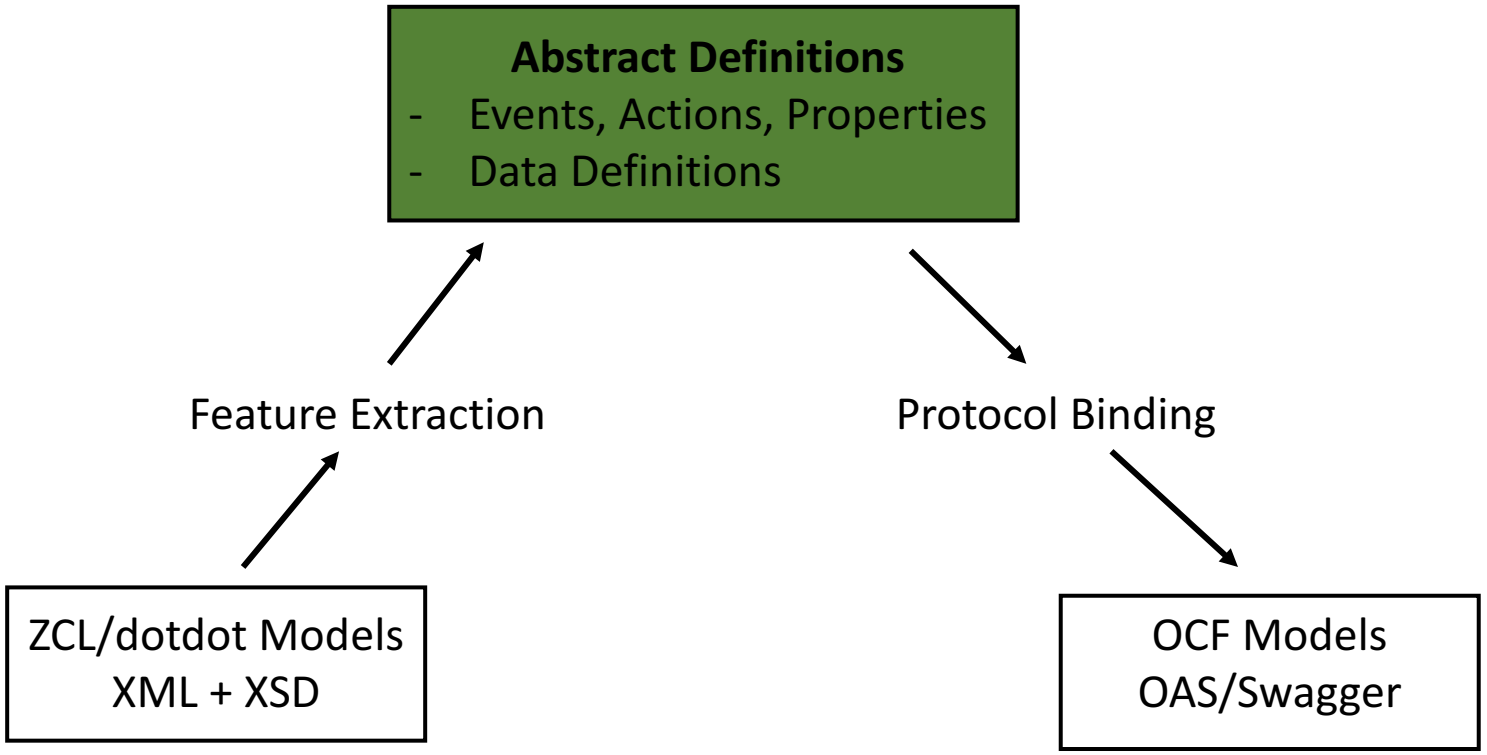
```
title: SwitchState
type: string
enum:
  - 'on'
  - 'off'
```

```
title: IntegerPercent
type: object
additionalProperties: false
properties:
  value:
    type: integer
    minimum: 0
    maximum: 100
  unit:
    type: string
    enum: ['%']
    default: '%'
required: ["value"]
```

Proposal for a Common Definition Format



Supports This Pattern



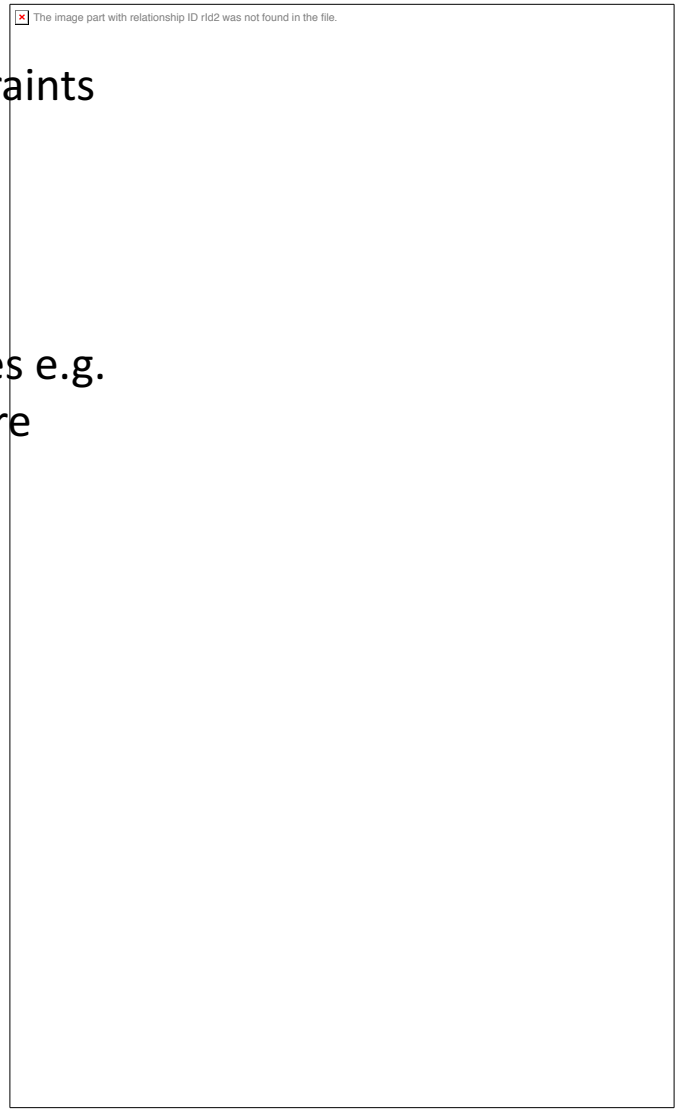
UML Model

Device Type and Constraints
e.g. Thermostat, Light

Composable Capabilities e.g.
onoff, level, temperature

Events, Actions, Properties

Data Types, Enums



Examples

- JSON-LD (JSON format with RDF extensions)
- Files for semantic definitions of specific types:
  - Thing (Device level definitions)
  - Capability (onoff, level…)
  - InteractionAffordance (Event, Action, Property)
  - Data Types (value types, enums)
- Definition hierarchy follows the UML model
- Core schema for the UML model in JSON-LD
- Full examples at: https://github.com/mjkoster/ODM-Examples
- (TBD) Thing definitions to apply optionality to Capability sets, Interactions, and Data Types

ST Sourced definitions

- ODM InteractionAffordance definitions, manually extracted from some SmartThings Capability definitions
- Attributes map to ODM Property class
- Commands map to ODM Action class

ST Based Capabilities

```
{
  "@id": "st:SwitchCapability",
  "rdfs:subClassOf": "odm:Capability",
  "rdfs:comment": "Basic On/Off Switch Capability",
  "rdfs:label": "SmartThings Switch Capability",
  "odm:hasInteractionAffordance": [
    "st:Switch.valueProperty",
    "st:Switch.onAction",
    "st:Switch.offAction"
  ]
},
{
  "@id": "st:SwitchLevelCapability",
  "rdfs:subClassOf": "odm:Capability",
  "rdfs:comment": "Capability to control the level",
  "rdfs:label": "SmartThings SwitchLevel Capability",
  "odm:hasInteractionAffordance": [
    "st:SwitchLevel.levelProperty",
    "st:SwitchLevel.setLevelAction"
  ]
}
```

Properties, Actions, Events

```
{
  "@id": "st:SwitchLevel.levelProperty",
  "rdfs:comment": "The current level setting",
  "rdfs:label": "SwitchLevel levelProperty",
  "@type": "odm.PropertyInteraction",
  "rdfs:subClassOf": "odm:InteractionAffordance",
  "odm:hasDataItem": "st:SwitchLevel.levelData"
},
{
  "@id": "st:SwitchLevel.setLevelAction",
  "rdfs:comment": "Action to set the level",
  "rdfs:label": "SwitchLevel setLevelAction",
  "@type": "odm:ActionInteraction",
  "rdfs:subClassOf":"odm:InteractionAffordance",
  "odm:hasDataItem": [
    "st:SwitchLevel.levelData"
    "st:SwitchLevel.rateData"
  ]
}
```

Data Items

```
{
  "@id": "st:Switch.valueData",
  "rdfs:comment": "value data for Switch (on/off string
encoding)",
  "rdfs:label": "SmartThings SwitchLevel.levelData",
  "rdfs:subClassOf": "odm:DataItem",
  "odm:DataItemType": "js:string",
  "js:enum": ["on", "off"]
},
{
  "@id": "st:SwitchLevel.levelData",
  "rdfs:comment": "Level data for SwitchLevel",
  "rdfs:label": "SmartThings SwitchLevel.levelData",
  "rdfs:subClassOf": "odm:DataItem",
  "odm:DataItemType": "js:integer",
  "js:minimum": 0,
  "js:maximum": 100
},
{
  "@id": "st:SwitchLevel.rateData",
  "rdfs:comment": "Rate time data for setLevelAction",
  "rdfs:label": "SmartThings SwitchLevel.rateData",
  "rdfs:subClassOf": "odm:DataItem",
  "odm:DataItemType": "js:integer",
  "js:minimum": 0,
  "js:maximum": 65535
}
```

ZCL Sourced definitions

- ODM InteractionAffordances, manually extracted from ZCL definitions
- Attributes map to ODM Property class
- Commands map to ODM Action class

ZCL Example

```
{
  "@id": "zcl:LevelCapability",
  "rdfs:subClassOf": "odm:Capability",
  "rdfs:comment": "Level Control Capability",
  "rdfs:label": "ZCL Level Capability",
  "odm:hasInteractionAffordance": [
    "zcl.Level.CurrentLevelProperty",
    "zcl.Level.RemainingTimeProperty",
    "zcl.Level.OnOffTransitionTimeProperty",
    "zcl.Level.OnLevelProperty",
    "zcl.Level.OnTransitionTimeProperty",
    "zcl.Level.OffTransitionTimeProperty",
    "zcl.Level.DefaultMoveRateProperty",
    "zcl.Level.MoveToLevelAction",
    "zcl.Level.MoveAction",
    "zcl.Level.StepAction",
    "zcl.Level.StopAction",
    "zcl.Level.MoveToLevelWithOnOffAction",
    "zcl.Level.MoveWithOnOffAction",
    "zcl.Level.StepWithOnOffAction"
  ]
}
```

ZCL Example

```
{
  "@id": "zcl.Level.MoveToLevelAction",
  "rdfs:comment": "Action move to a given level",
  "rdfs:label": "ZCL Level.MoveToLevelAction",
  "@type": "odm:ActionInteraction",
  "rdfs:subClassOf": "odm:InteractionAffordance",
  "odm:hasDataItem": [
    "zcl:Level.LevelData",
    "zcl:Level.TransitionTimeData"
  ]
},
{
  "@id": "zcl.Level.MoveAction",
  "rdfs:comment": "Action move at a given rate",
  "rdfs:label": "ZCL Level.MoveAction",
  "@type": "odm:ActionInteraction",
  "rdfs:subClassOf": "odm:InteractionAffordance",
  "odm:hasDataItem": [
    "zcl:Level.MoveModeData",
    "zcl:Level.RateData"
  ]
},
```

ZCL Example

```
{
  "@id": "zcl:Level.OffTransitionTimeData",
  "rdfs:comment": "Off Transition Time Data",
  "rdfs:label": "ZCL Level.OffTransitionTimeData",
  "rdfs:subClassOf": "odm:DataItem",
  "odm:DataItemType": "js:integer",
  "js:minimum": 0,
  "js:maximum": 65534
},
{
  "@id": "zcl:Level.DefaultMoveRateData",
  "rdfs:comment": "Default Move Rate Data",
  "rdfs:label": "ZCL Level.DefaultMoveRateData",
  "rdfs:subClassOf": "odm:DataItem",
  "odm:DataItemType": "js:integer",
  "js:minimum": 0,
  "js:maximum": 254
}
```

OCF Sourced definitions

- ODM InteractionAffordances, manually extracted from OCF Resource Type definitions
- Properties map to ODM Property class
- Actions added for simple cases like brightness change with ramp time

OCF Example

```
{
  "@id": "ocf:BrinarySwitchCapability",
  "rdfs:subClassOf": "odm:Capability",
  "rdfs:comment": "On/Off Switch Capability",
  "rdfs:label": "OCF BinarySwitch Capability",
  "odm:hasInteractionAffordance": [
    "ocf:BinarySwitch.valueProperty",
    "ocf.BinarySwitch.OnAction",
    "ocf.BInarySwitch.OffAction"
  ]
},
{
  "@id": "ocf:BrightnessCapability",
  "rdfs:subClassOf": "odm:Capability",
  "rdfs:comment": "Capability to control the
brightness",
  "rdfs:label": "OCF Brightness Capability",
  "odm:hasInteractionAffordance": [
    "ocf:Brightness.BrightnessProperty",
    "ocf:Brightness.SetBrightnessAction"
  ]
},
```

OCF Example

```
{
  "@id": "ocf:Brightness.brightnessProperty",
  "rdfs:comment": "Brightness Property",
  "rdfs:label": "OCF Brightness.brightnessProperty",
  "@type": "odm.PropertyInteraction",
  "rdfs:subClassOf": "odm:InteractionAffordance",
  "odm:hasDataItem": "ocf:Brightness.brightnessData"
},
{
  "@id": "ocf:Brightness.SetBrightnessAction",
  "rdfs:comment": "Set Brightness Action",
  "rdfs:label": "OCF Brightness.SetBrightnessAction",
  "@type": "odm.ActionInteraction",
  "rdfs:subClassOf": "odm:InteractionAffordance",
  "odm:hasDataItem": [
    "ocf:Brightness.BrightnessData",
    "ocf.RampTime.RampTimeData"
    ]
},
```

OCF Example

```
{
  "@id": "ocf:Brightness.brightnessData",
  "rdfs:comment": "Brightness Data",
  "rdfs:label": "OCF Brightness.brightnessData",
  "rdfs:subClassOf": "odm:DataItem",
  "odm:DataItemType": "js:integer",
  "js:minimum": 0,
  "js:maximum": 255
},
{
  "@id": "ocf:RampTime.ramptimeData",
  "rdfs:comment": "Ramp Time Data",
  "rdfs:label": "OCF RampTime.ramptimeData",
  "rdfs:subClassOf": "odm:DataItem",
  "odm:DataItemType": "js:integer",
  "js:minimum": 0,
  "js:maximum": 65535
},
```

OCF Example

```
{
  "@id": "ocf:BinarySwitch.OnAction",
  "rdfs:comment": "Binary Switch On Action",
  "rdfs:label": "OCF BinarySwitch.valueProperty",
  "@type": "odm.ActionInteraction",
  "rdfs:subClassOf": "odm:InteractionAffordance",
  "odm:hasDataItem": "ocf:BinarySwitch.valueOnData"
},

{
  "@id": "ocf:BinarySwitch.OnValueData",
  "rdfs:comment": "Boolean value for On state",
  "rdfs:label": "OCF BinarySwitch.valueData",
  "rdfs:subClassOf": "odm:DataItem",
  "odm:DataItemType": "js:boolean",
  "js:const": true
},
```

OCF Protocol Binding/Mapping

- Example of an OCF Resource Type definition with extensions for modeling ODM Actions
- Enables an ODM-Capable Bridge or adaptation client to use ODM to generate OCF API calls

OCF Definition with annotations

```
    "title": "Binary Switch",
    "version": "v1.1.0-20160519",
    "license": {
      "name": "copyright 2016-2017 Open Connectivity
Foundation, Inc. All rights reserved.",
    }
  },
  "@type": "ocf:BinarySwitchCapability",
  "schemes": ["http"],
  "consumes": ["application/json"],
  "produces": ["application/json"],
  "paths": {
    "/BinarySwitchResURI" : {
      "@type": [
        "ocf:BinarySwitch.valueProperty",
        "ocf:BinarySwitch.OnAction",
        "ocf:BinarySwitch.OffAction"
      ],
```

OCF Definition with annotations

```
  (...)
  "minItems": 1,
  "readOnly": true,
  "type": "array"
},
"value" :
        {
  "@type": [
    "ocf:BinarySwitch.valueData",
    "ocf:BinarySwitch.OnValueData",
    "ocf:BinarySwitch.OffValueData"
  ],
  "description": "Status of the switch",
  "type": "boolean"
},
```

Example Device Level Definitoin

```
{
  "@id": "st:DimmableLight",
  "rdfs:subClassOf": "odm:Thing",
  "rdfs:comment": "Simple Dimmable Light Bulb",
  "rdfs:label": "SmartThings DimmableLight",
  "odm:hasCapability": [
    "st:SwitchCapability",
    "st:SwitchLevelCapability"
  ]
}
```