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# OIC Standards Overview

Joint Technical Workshop  
July 20<sup>th</sup> 2015

Open Interconnect Consortium

# Table of Contents

- **OIC Spec A - Core Framework**
- **OIC Spec A - Smart Home**
- **OIC Spec A - Security**



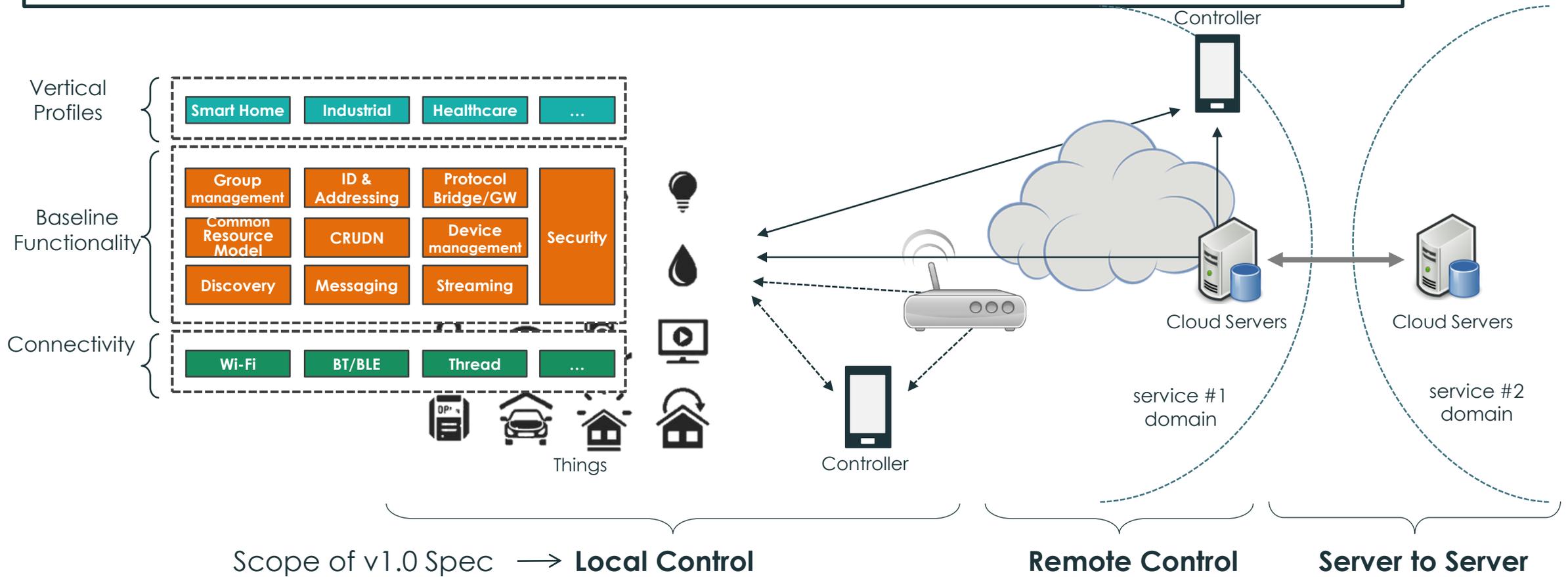
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# OIC Standards-Core Framework

# Introduction of OIC Spec

## Technical Goals

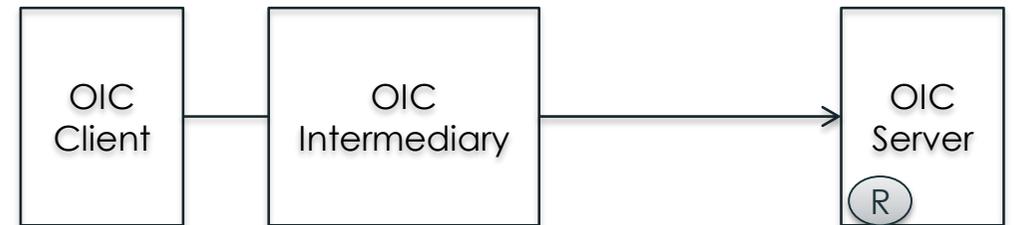
- To Develop Lightweight Framework portable to any device (including very constrained devices)
  - Common solution across different industry verticals such as Smart Home, Industrial, Healthcare etc.
  - Refer to the IETF open technologies as much as we can



- **OIC adopted RESTful Architecture**
- **Current OIC Architecture defines 3 logical roles that devices can take**
  - OIC Server : A logical entity that exposes hosted resources
  - OIC Client : A logical entity that accesses resources on an OIC Server
  - OIC Intermediary : A logical entity bridging messages between an OIC Server and Client



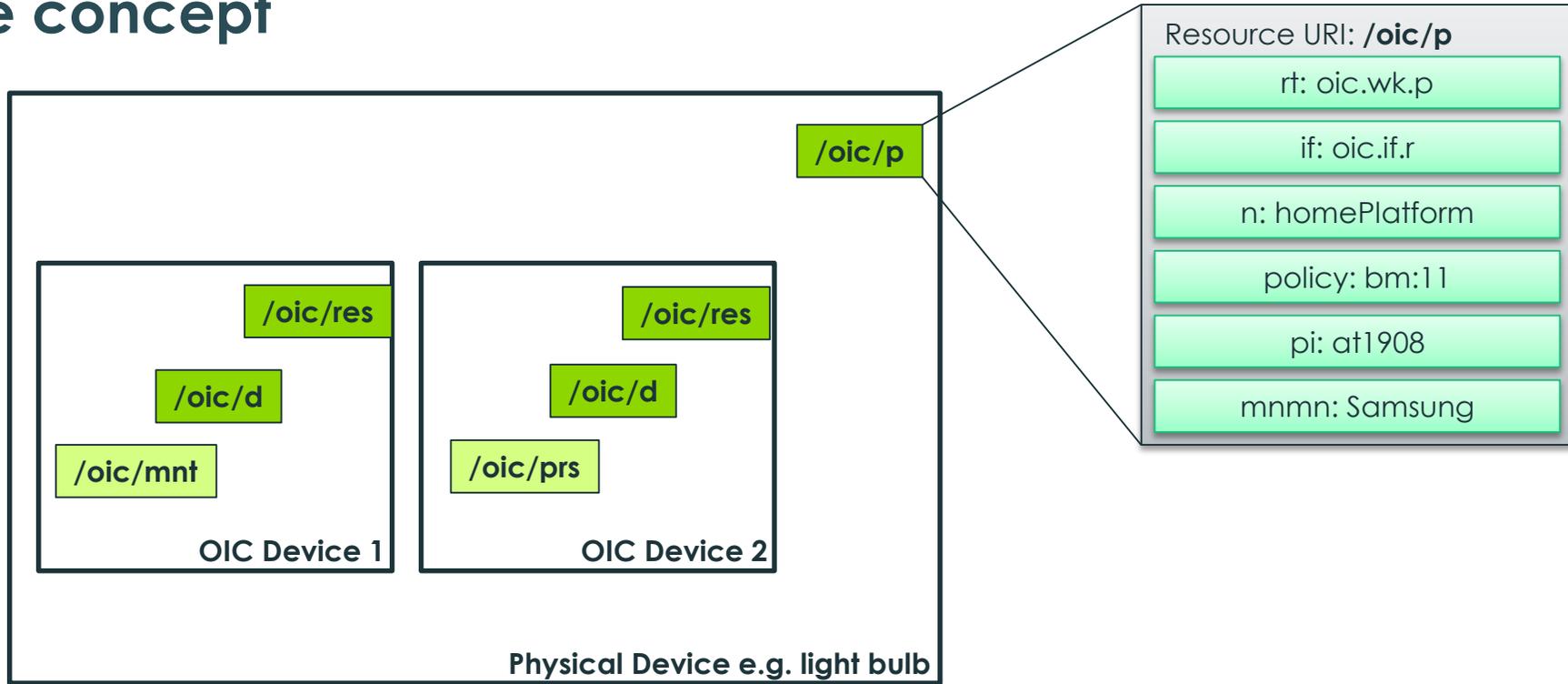
Model 1



Model 2

# Organization of an OIC Device

## OIC Device concept



 Mandatory  
 Optional

# Resource Model

- **Resource Type** : A Class or Category of Resource
- **Resource** : An Instance of the Resource Type
- **Resource Properties** : Key-Value pairs representing different aspects of the Resource

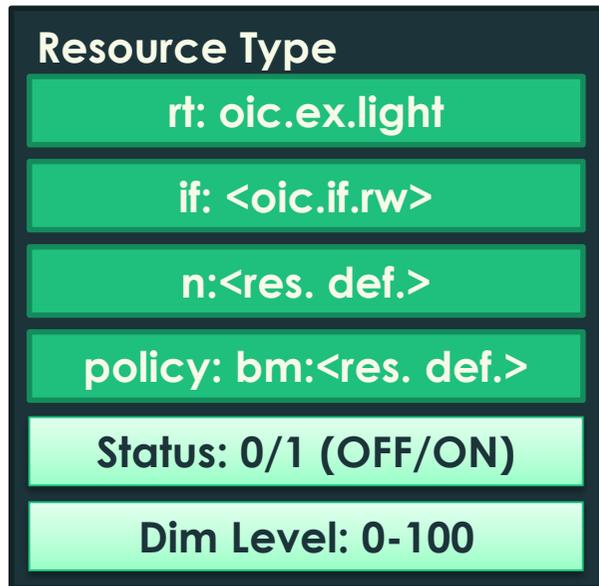
Fixed URI	Resource Type Title	Resource Type ID ("rt" value)	Interfaces	Resource Properties			Description
none	Humidity	oic.r.humidity	"oic.if.def"	rt	string	mandatory	represents the humidity of the environment
				if	string	mandatory	
				n	string	no	
				policy	string	no	

## Resource Type Definition

Mandatory here means Mandatory to Support and not on the Wire

Property Name	Property Title	Property Value	Value Type	Value Rules	Access Modes	Mandatory	Description
rt	ResType		string	The resource type name shall be no longer than 64 chars UTF-8)		Yes	The property name rt is as described in IETF RFC 6690.
if	Interface		string			Yes	
n	Name		string			No	
P	Policy		string			No	

# Example Resource Type (oic.ex.light)

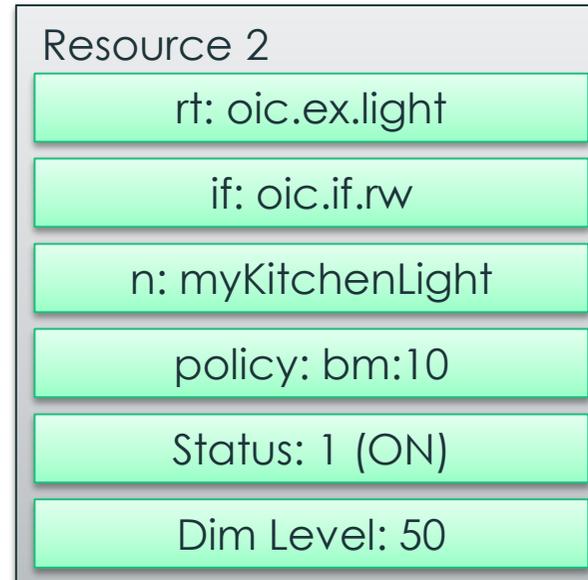


Common Properties

Resource Specific Properties



URI: /oic/light1



URI: /oic/light2

# Common Properties

- Common properties are properties which keep their semantics same across different Resources
- Some Common Properties are Mandatory to be supported on each Resource
- Properties mandatory to send over Wire are defined in the JSON Schema of each Resource

## Resource Type (rt)

**Name given by definer of "Resource Type".**  
For e.g. "oic.ex.light" or  
"oic.samsung.refrigerator"

**rt: oic.ex.light**

## Resource Interface (if)

**List of Interfaces that are bound to a resource type. This is also defined by the definer of "Resource Type"**

**if: <oic.if.rw, oic.if.ll, oic.if.b>**

## Name (n)

**Human Friendly Name of the Resource Type**

**n:<res. def.>**

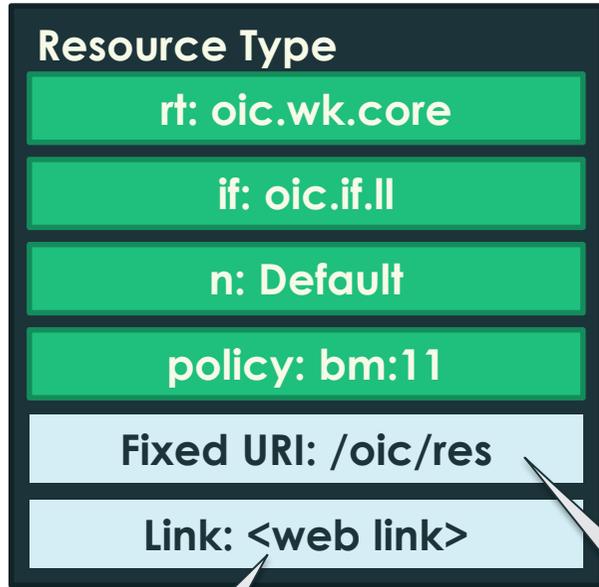
## Policy (p)

**Bitmap indicating**  
1) If the Resource is Discoverable  
2) If the Resource is Observable

For e.g. bm:00 or bm:10 etc.

**policy: bm:<res. def.>**

# Core Resources (Well Known)

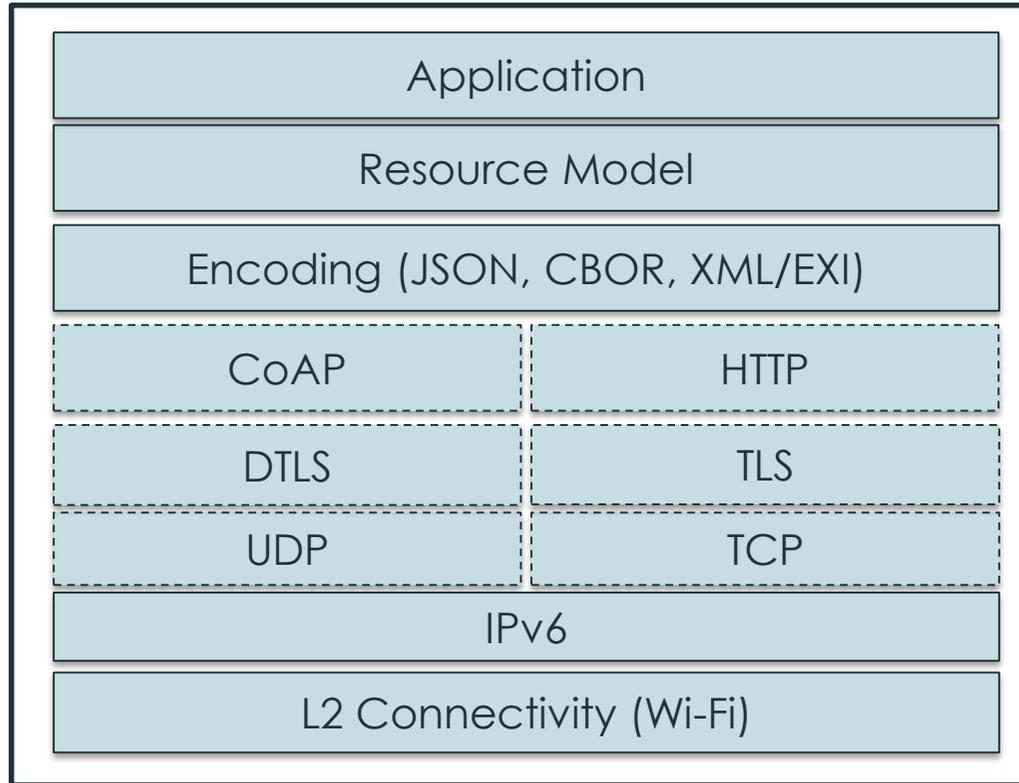


Collection

Singleton

Friendly Name	Fixed URI	Core Function	Support
Default	/oic/res	Discovery	Mandatory
Device	/oic/d	Discovery, Device Management	Mandatory
Platform	/oic/p	Discovery	Mandatory
Resource Type	/oic/rts	Discovery	Optional
Interface	/oic/ifs	Discovery	Optional
Advertisement	/oic/ad	Presence	Optional
Monitoring	/oic/mon	Device Management	Optional
Maintenance	/oic/mnt	Device Management	Optional

Resource URI Format: <scheme>://<Authority>/<Path>?<Query>  
 E.g. coap://107.108.0.3:5683/oic/res?rt=oic.ex.light



**Current OIC Stack**

## Alternatives

Encoding	JSON; XML/EXI; CBOR
IP Version	v6
Transport Protocol	CoAP; HTTP

## All CoAP Nodes: Multicast Group



IPv6    FFOX::FD: 5683

JOIN



OIC Client



## All CoAP Nodes: Multicast Group

Multicast GET /oic/res?rt=oic.ex.light

Unicast Response



OIC Client

Discovery URI	M/U	Specified Behavior
/oic/res	M	Discover all oic resources in the network (subnet)
/oic/res?rt=oic.ex.light	M	Discover all oic resources with resource type "oic.ex.light"
/oic/res?n=mylight	M	Discover oic resource with name "mylight"
/oic/rts	U	Discover all resource types supported on a device (optional)

**Response shall conform to standard JSON Schema**

**All behaviors are specified using function specific RAML Files**

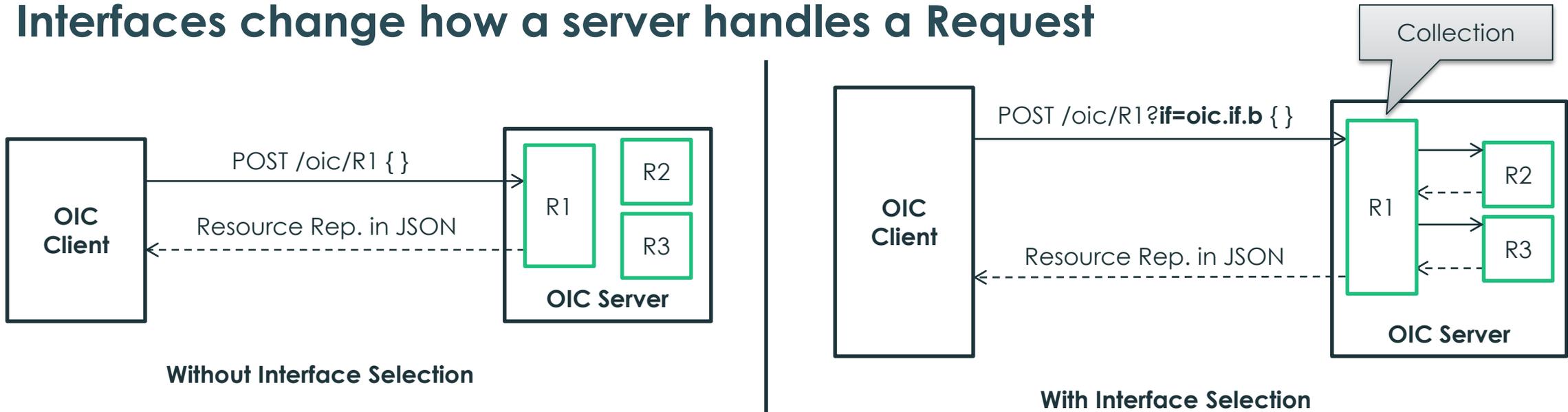


Some devices in All CoAP Nodes group may have /oic/ad resource

Advertising device can do a Unicast post if device hosting /oic/ad is already known

Resource Type
rt: oic.wk.ad
if: oic.if.r
n: Advertisement
policy: bm:10
Fixed URI: /oic/ad
ttl: <res. def.>
href: <res. def.>
trg: <Creation;M;D>

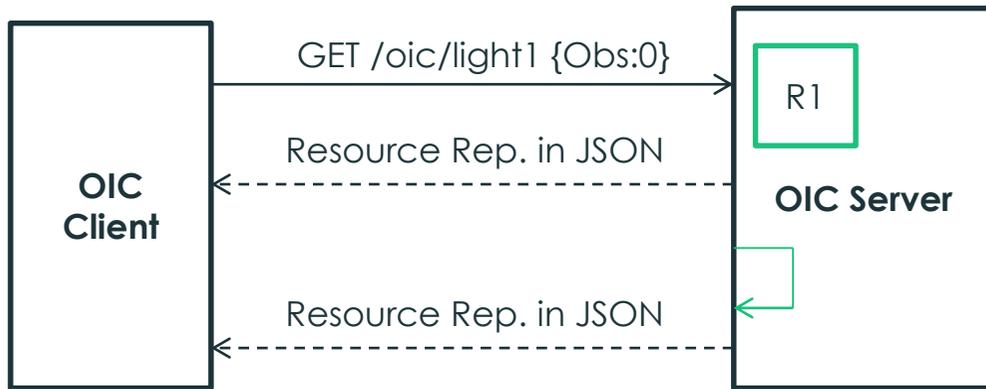
## Interfaces change how a server handles a Request



Interface Type	Methods Applicable	Description
System Default (oic.if.def)	Retrieve, Update	Returns the complete representation of resource
Linked List (oic.if.ll)	Retrieve	Lists the referenced URIs of the resource
Batch (oic.if.b)	Retrieve, Update	Requests are transmitted to referenced resource URIs
Read (oic.if.r)	Retrieve	Interaction is limited to Read only
Read Write (oic.if.rw)	Retrieve, Update	Interaction is limited to Read and Write

# Notification (Observe)

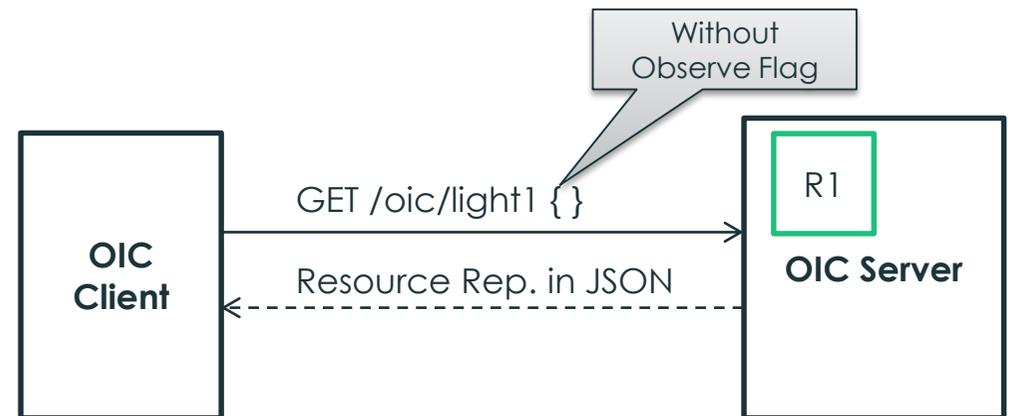
## ● Observing a single resource for its state changes



Start Observe

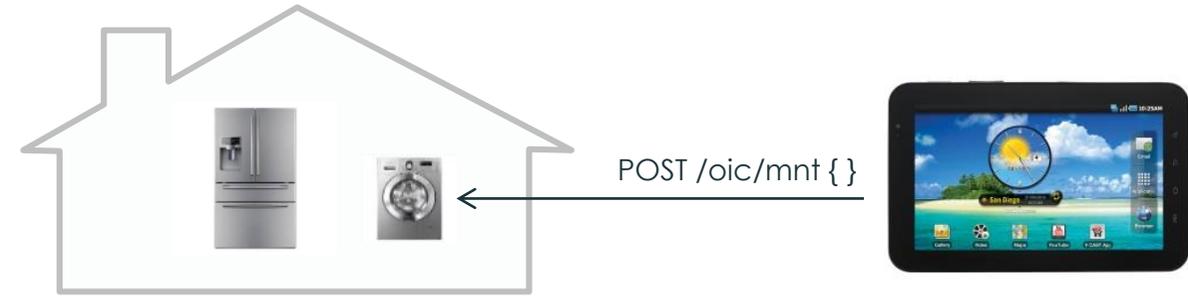
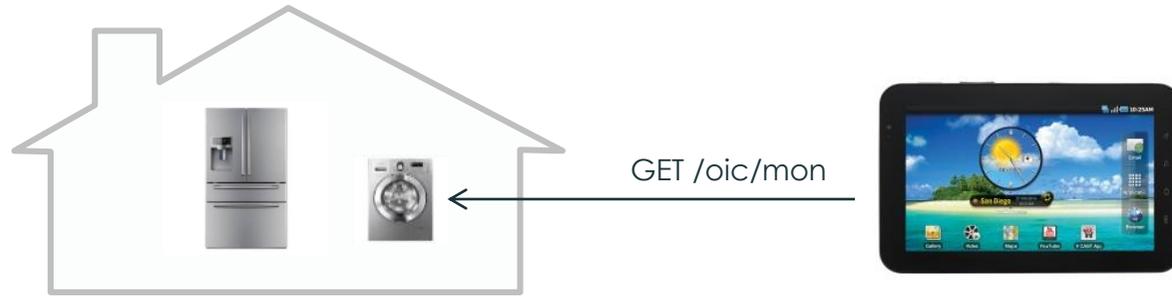


Cancel Observe (Option 1)



Cancel Observe (Option 2)

# Device Management



## Resource Type

rt: oic.wk.mon

if: oic.if.r

n: Monitoring

policy: bm:11

Fixed URI: /oic/mon

av: <res. def.>

lat: <res. def.>

ds: <res. def.>

Resource which collects Device Statistics like packets sent, packets received, last acted time etc.

Monitoring

## Resource Type

rt: oic.wk.mnt

if: oic.if.rw

n: Maintenance

policy: bm:11

Fixed URI: /oic/mnt

fr: <res. def.>

rb: <res. def.>

ssc: <res. def.>

Resource which enables execute actions on resources like Reboot, Factory Reset and Start Statistics Collection etc.

Maintenance



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# OIC Standards-SmartHome

- Specifications are split in 2 documents:
  - Device specification
  - Resource specification

***The Device specification uses the resources defined in the resource specification***

- Contains profiles of
  - Core specification
  - security specification
- Contains list of smart home devices
- Each Smart home device definition contains:
  - unique identifier (rt)
  - a list of mandatory resources

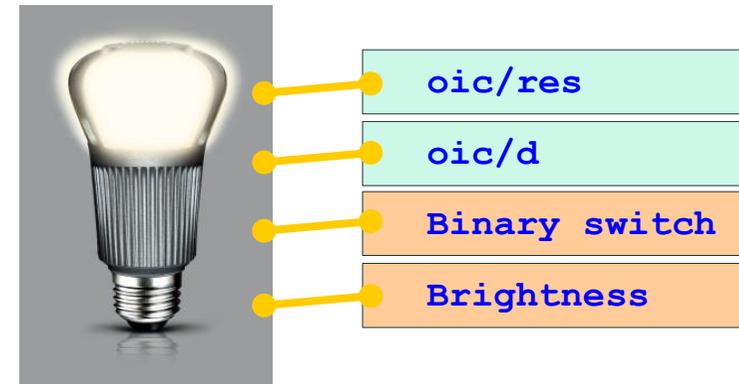
<b>OIC SmartHome Device</b>
Vendor Smart Home Extensions
Vendor Core Resources Extensions
Smart Home Device specification
Smart Home Resources
Core Resources
Smart Home Core Profiles

# Device example: light device (oic.d.light)

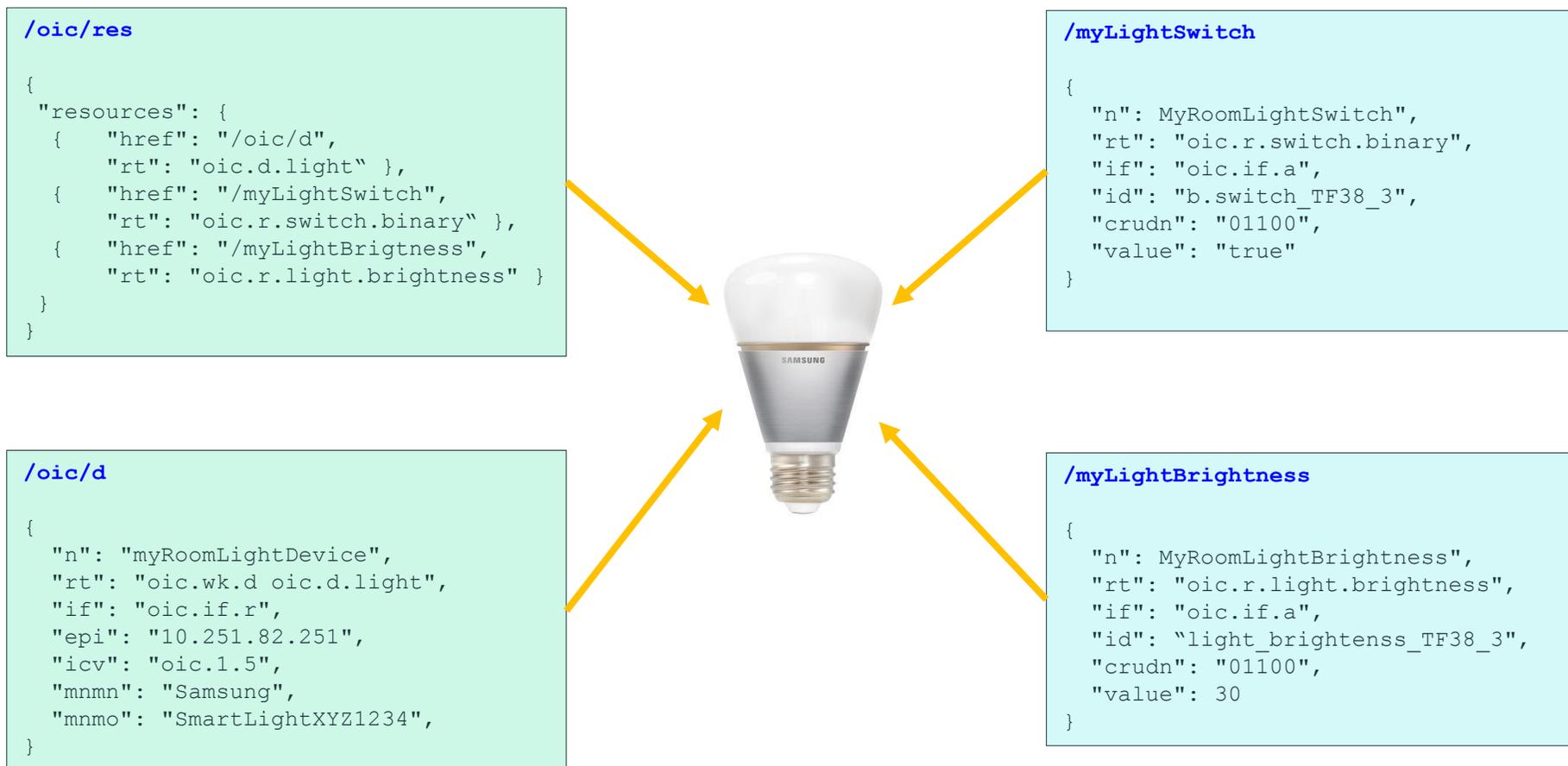
- Example overview
  - Smart light device with i) binary switch & ii) brightness resource
- Device type: Light device (oic.d.light)
- Associated resources
  - Core resources: ① oic/res, ② oic/d
  - Device specific resources: ③ Binary switch (oic.r.switch.binary),
  - Other optional resources can be exposed, in this example ④ Brightness resource (oic.r.light.brightness)

## Example: Smart light device with 4 resources

Device Title	Device Type	Associated Resource Type	M/CM/O
Light	oic.d.light	oic/res (oic.wk.core)	M
		oic/d (oic.d.light)	M
		Binary switch (oic.r.switch.binary)	M
		Brightness (oic.r.light.brightness)	O



# Device example: Smart light device



- List of **reusable resources** that are used in an Smart Home Device
  - Contains generic list of error codes
  - Uses core definitions
- Each Smart home resource definition contains:
  - unique identifier (rt)
  - Indication if the resource is an sensor or actuator
  - List supported methods
  - List per method the JSON schema for input and output

***Resources are specified in RESTful API Modelling Language (RAML)***

- Resources are re-usable across device types
- A client does not have to 'know' about the specifics of the device to 'know' how to understand or interact with a resource
- A vendor can extend or add:
  - Their own Device Types
  - Their own Resource Types
  - Their own Properties to extend an existing Resource Type

# Smart Home Known Device Types for Spec A

Confidential

Device Type	Minimum Resource Set
Air Conditioner	Binary Switch, Temperature
Air Purifier	Binary Switch
Blind	Open Level
Dishwasher	Binary Switch, Mode
Door	Open Level
Clothes Dryer	Binary Switch, Mode
Clothes Washer	Binary Switch, Mode
Fan	Binary Switch
Garage Door	Door
Light	Binary Switch
Oven	Binary Switch, Temperature (2)
Printer	Binary Switch, Operational State

Device Type	Minimum Resource Set
Refrigerator	Binary Switch, Refrigeration, Temperature (2)
Robot Cleaner	Binary Switch, Mode
Smart Plug	Binary Switch
Switch	Binary Switch
Thermostat	Temperature (2)

Exposure of an OIC Device Type is Mandatory.  
If an OIC Server hosts an OIC known device then it shall follow all normative requirements in the Device Specification applicable to that Device.

# Smart Home Known Resource Types for Spec A

Resource Types	Spec A
Air Flow	X
Air Flow Control	X
Battery	X
Binary switch	X
Brightness	X
Colour Chroma	X
Colour RGB	X
Dimming	X
Door	X
Energy Consumption	X
Energy Usage	X
Humidity	X
Icemaker	X
Lock	X

Resource Types	Spec A
Lock Code	X
Mode	X
Open Level	X
Operational State	X
Ramp Time	X
Refrigeration	X
Temperature	X
Time Period	X

Exposure of the minimum set of resource types for a hosted device type is mandatory.  
If an OIC Server hosts an OIC known resource then it shall follow all normative requirements in the Resource Specification applicable to that Resource.

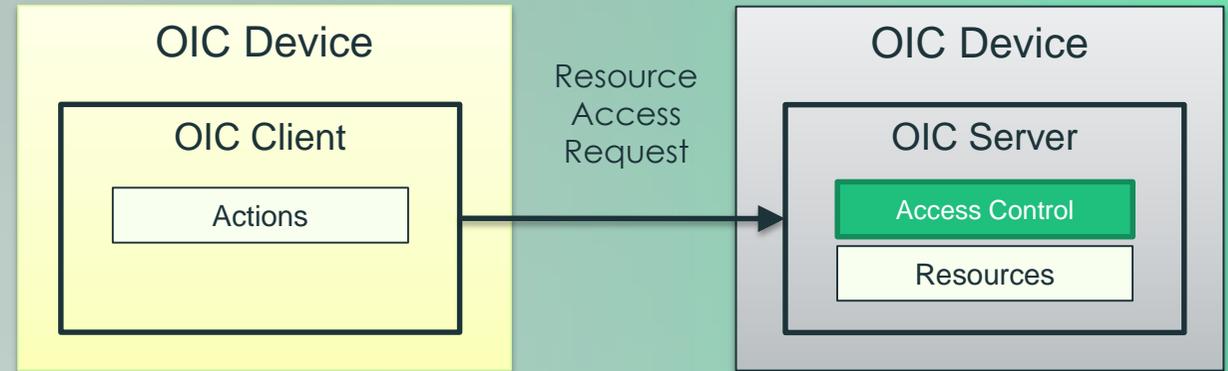


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# OIC Standards - Security

# OIC Terminology

- A Device is an OIC stack instance
- Devices implement roles: Client, Server, Intermediary
- Devices have Resources and perform Actions
- Resources have Properties



# Security Objectives

- Cloud-based service requires Remote Access mechanisms
  - RA servers can see data.
- Onboarding security, Transfer of ownership, provisioning/  
bootstrapping
  - PSK creation and setup, proximity required
- Details of security/ ACL resources
- Decentralized Asymmetric keys as well as PKI, flexible ID generation (UAID)
- Use of ECCs for key exchanges
- Implementation-agnostic platform hardening requirements/ APIs, secure resource mgmt
- Resource URLs are not hierarchical. ACLs are not inherited. ACL @device, group and resource level, not property level
- ACE both ID based and role based

