AN INTRODUCTION TO

IPSO SMART OBJECTS

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1. IOT HISTORY

MOVING INTO IOT

Machine-to-Machine

- Point problem driven
- Connected device centric

- Internal bus objectives
- B2B
- Consultancy & SI
- In-house deployment

- Vertical silos
- Single-app devices
- Proprietary industry tech
- Specialized s/w dev't

Internet of Things

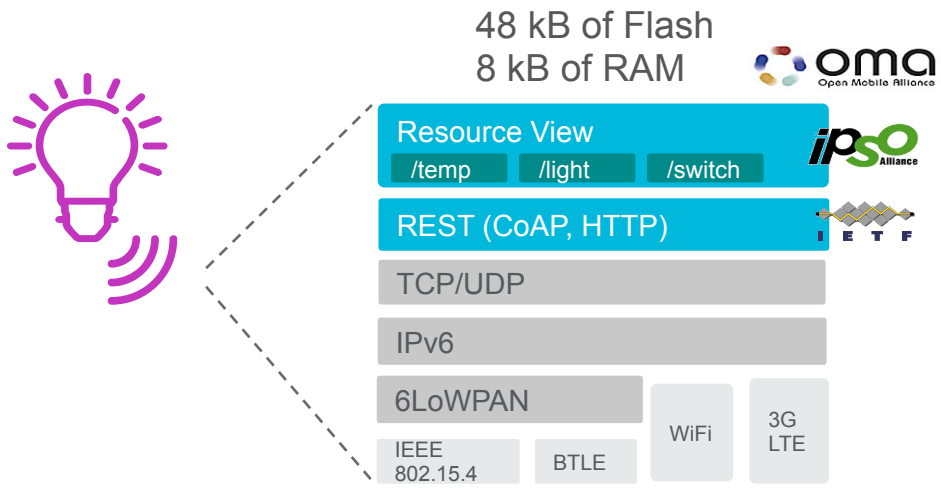
- Complex problems
- Remote operations

- Marketplaces and Value Networks
- B2B2C
- Open web and innovation
- Cloud and aaS

- Horizontal integration
- Generic devices
- Standards & open source
- Open APIs & dev't

MAKE DEVICES GO MAINSTREAM

- Go IP
  - Reduce technology fragmentation
  - Drive IP to the “tiniest of devices”
- Go Web
  - Use standard web technologies
  - Ease enterprise SOA integration
  - Attract the global developer community
- Go Simple
  - Make devices application generic
  - Drive value from devices to cloud enablement
  - Break device silos



2. IOT PROTOCOLS

THE WEB

› HTTP and REST

- Defines a client/server model and a request/response communication model.
- Support of extensive representation formats (e.g. HTML, JSON, XML etc.)
- Web content can be anything (HTML files, images, video…) each piece of information is a resource.
- Defines some methods to indicate the server what to do. (GET, POST, PUT, HEAD, DELETE, TRACE).
- Statelessness, requests are performed with the information provided only in that request
- Resources are identified with identifiers (URI), either by location or by name.
- Resources are accessible via an uniform locator (URL)

```
PROTOCOL://HOST_NAME:PORT /RESOURCE_PATH?RESOURCE_INPUT
```

- Resources can be identified with an unique identity (URN)

```
urn:NAMESPACE_IDENTIFIER:SPECIFIC_STRING
```

COAP

- It is a RESTful protocol for constrained devices and networks. Similar to HTTP:
  - Client/server (although now tending more to P2P model) & Request/Response
  - GET, POST, PUT and DELETE Methods
  - Same key concepts (Media types, URL, URN…)
- Resource discovery via the Resource Directory (RD)

```
Request   coap://HOST_ADDRESS:PORT_NUMBER/PATH?QUERY
Response coap://ericsson.com:5683/rd/jorvas/room/541/temperature/
```

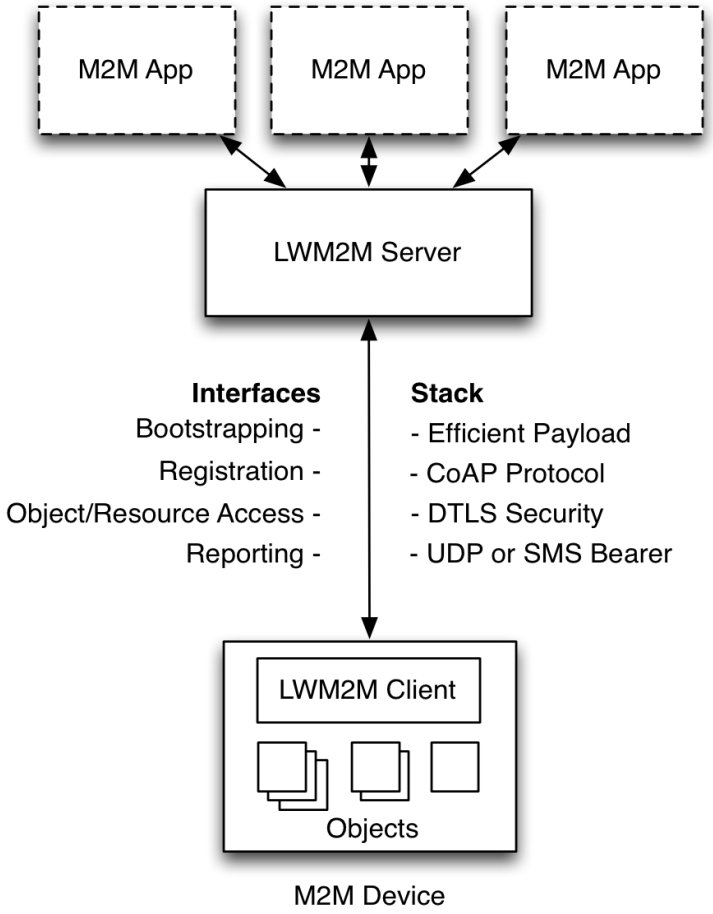
- The *well-known* URI

```
coap://[2001:db8::2:1]/.well-known/core
```

- IPv6 oriented (using 6LowPAN)
- UDP preferred instead of TCP, SMS also possible
  - Reliability is ensured by using with different message types:
  - *Confirmable* (CON)*, non-confirmable* (NON), *acknowledgement* (ACK) and *reset* (RST).
- Observe/Notify, adding an “observe” flag in the CoAP GET Request
  - Introduces a Publish/Subscribe model for constrained devices.

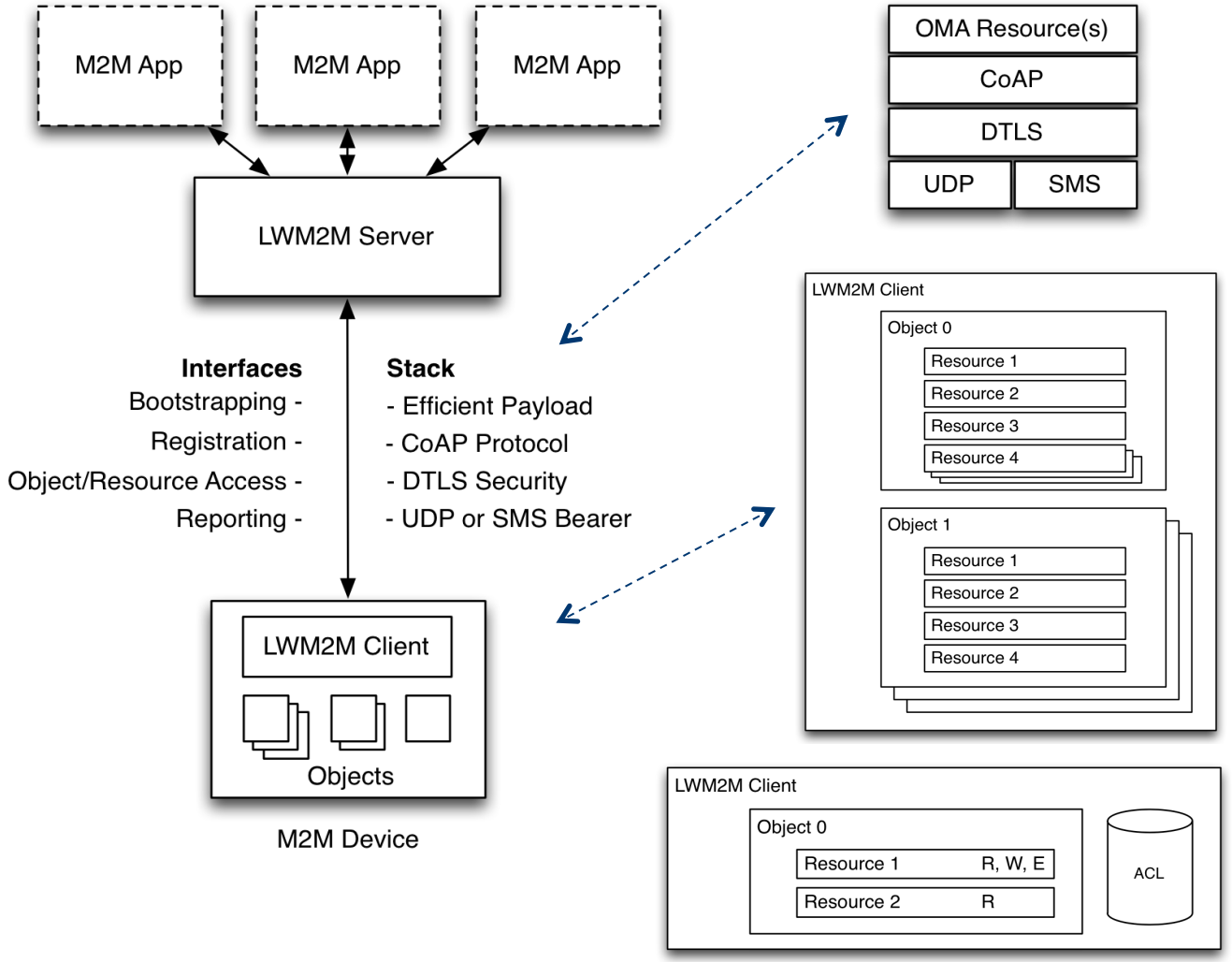
OMA LWM2M

- Based on CoAP (runs on top) and used for management and control of constrained devices
- Provides a set of interfaces for managing of constrained devices.
  - Bootstrap
  - Registration
  - Information Reporting
  - Device Management
  - Service Enablement
- Swaps “server” and “client” roles. A Constrained device would then run at least a CoAP Server and LWM2M Client.
- Also allows for operations on objects (RWX, Access Control, Observation, Notification)
- Offers a simple and reusable object based model.



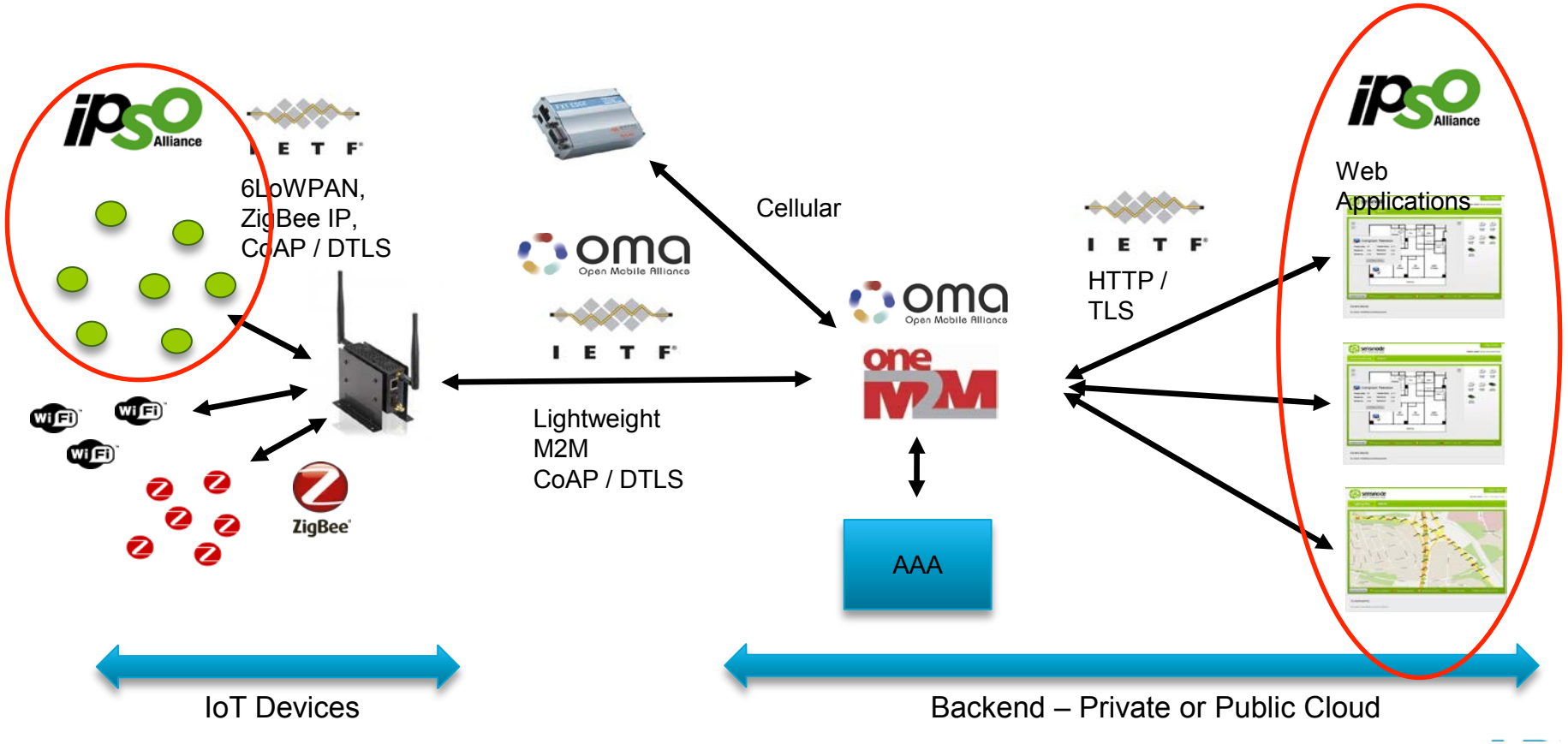
IPSO OBJECTS

- First introduced in LWM2M
- To ensure application interoperability
- Make it simple to add new resources.
- Common design pattern that is independent of the protocol used (CoAP, HTTP, MQTT, SNMP, TR69,…)
- To provide the building blocks to semantically define more complex devices
  - Washing Machine = sensors for humidity, temperature, water level, water-valves (for the hoses going to to/from it), a pump, a timer, electricity sockets, a capacitor…



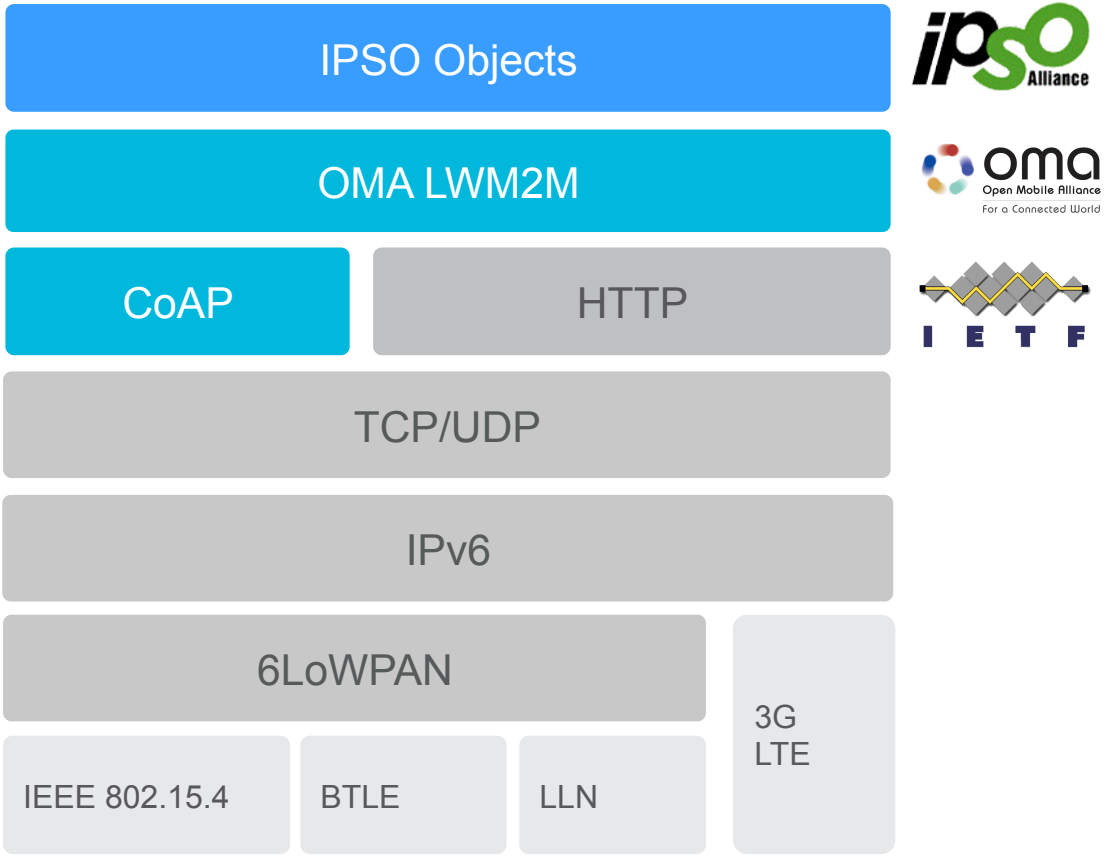
3. IPSO SMART OBJECTS

RELATIONSHIP WITH OTHER STANDARDS

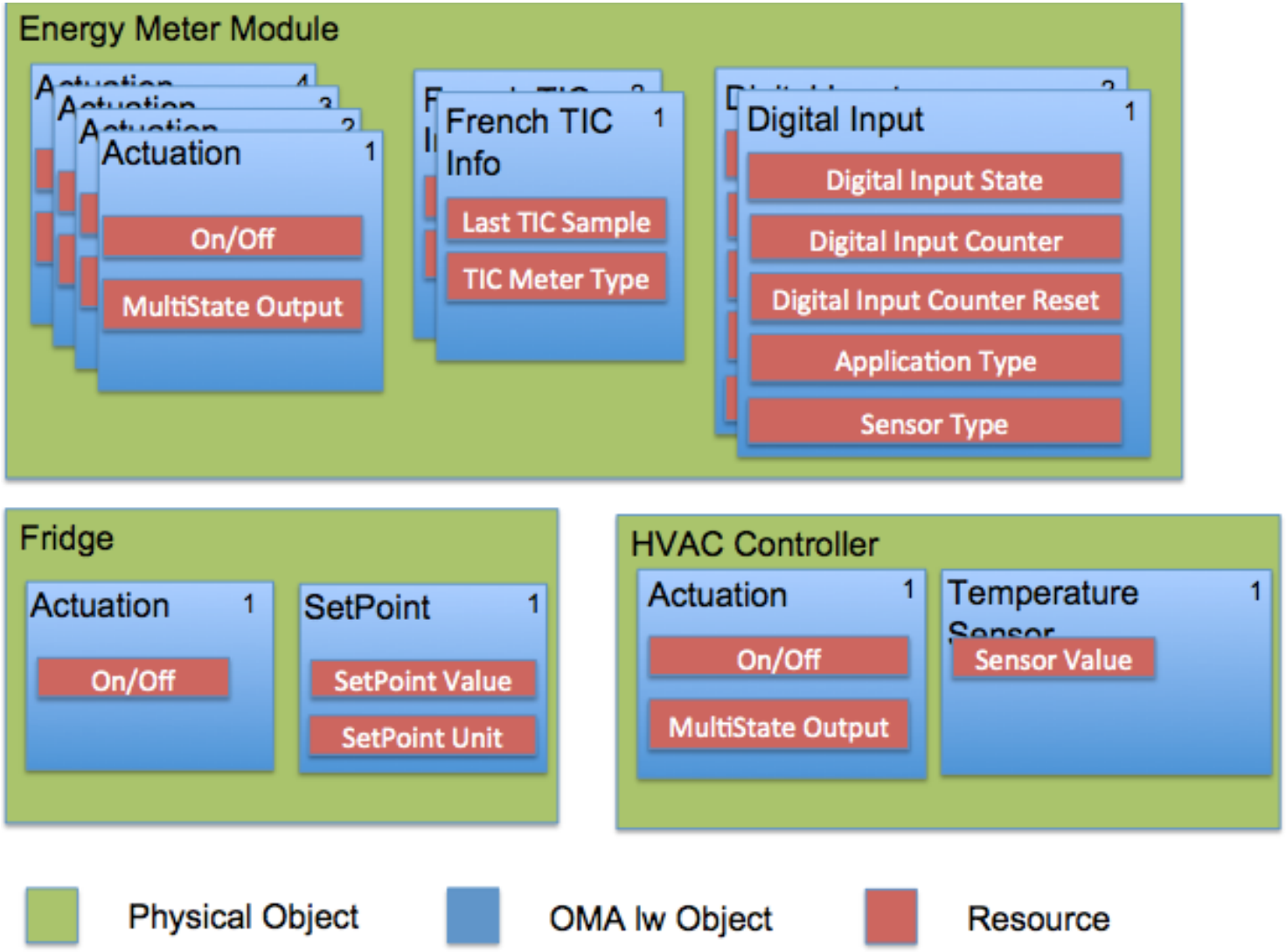


AFTER IP – THE WEB IN CONSTRAINED DEVICES

- RESTful web services to embedded devices
  - Eases enterprise SOA integration
  - Eases application development – Web programming∂
- HTTP or CoAP possible
  - CoAP (and EXI) for constrained environments, including Observe
  - HTTP-CoAP interworking
- Resource view
  - Web resources – web linking
  - Semantic annotations and simple profiles preferred
  - XML - EXI, JSON
- “Open” means discovery
  - publication and look-up
- Wrapping of Legacy devices

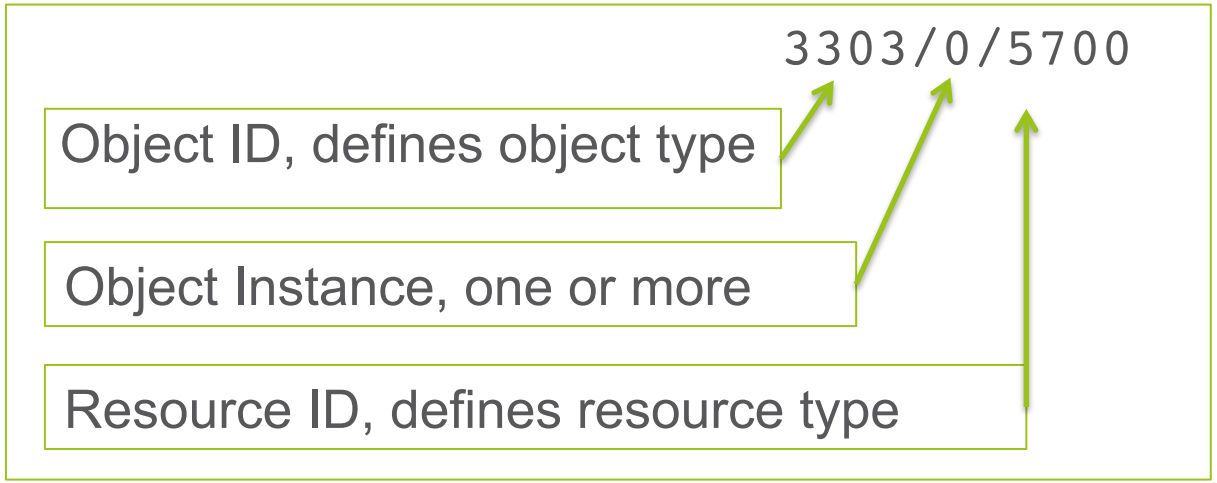


IPSO SMART OBJECT STRUCTURE I



IPSO SMART OBJECT STRUCTURE II

- REST API with a URI template
  - Objects
  - Object Instances
  - Resources
  - (Resource Instances)
- Reusable resource and object IDs
  - Common definitions for concepts
  - Map to semantic terms e.g. temperature, currentValue
  - IDs are registered with the OMNA
- Can be embedded in a path hierarchy on the server
  - /home/weather/3303/0/5700

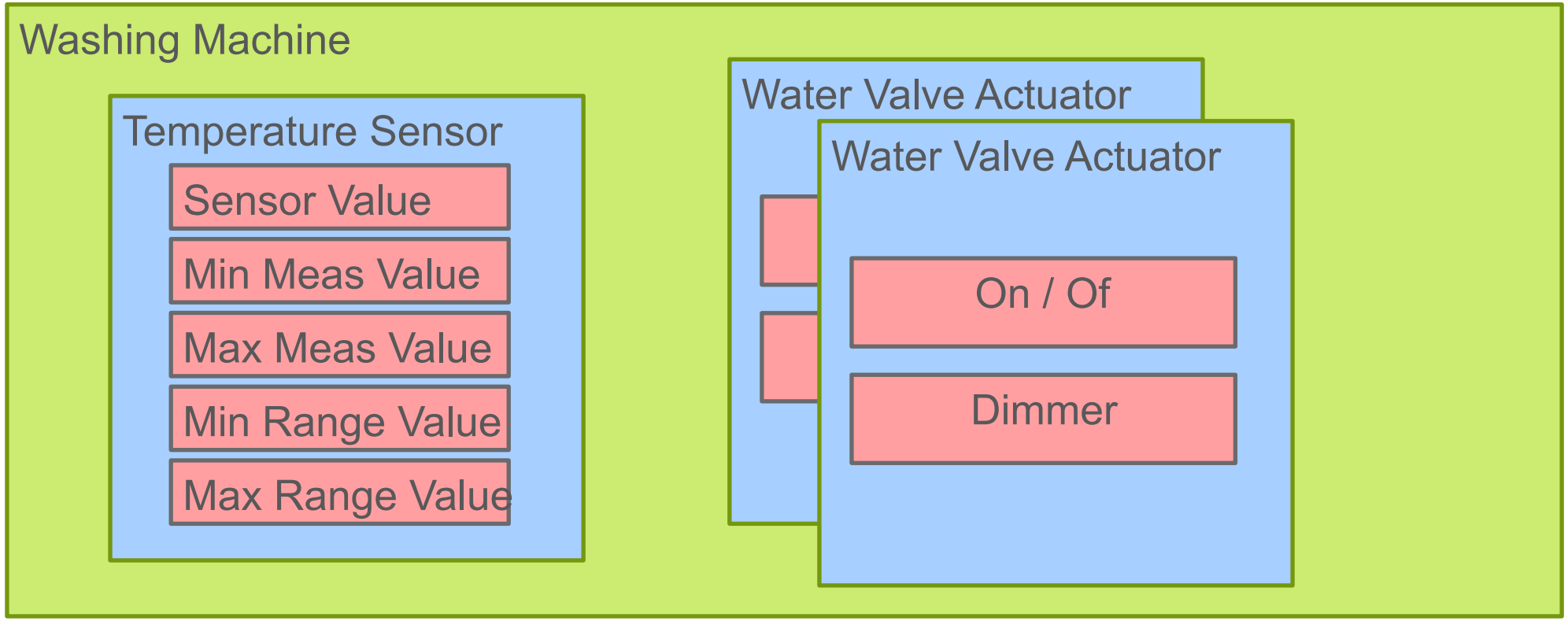


IPSO BAROMETER OBJECT

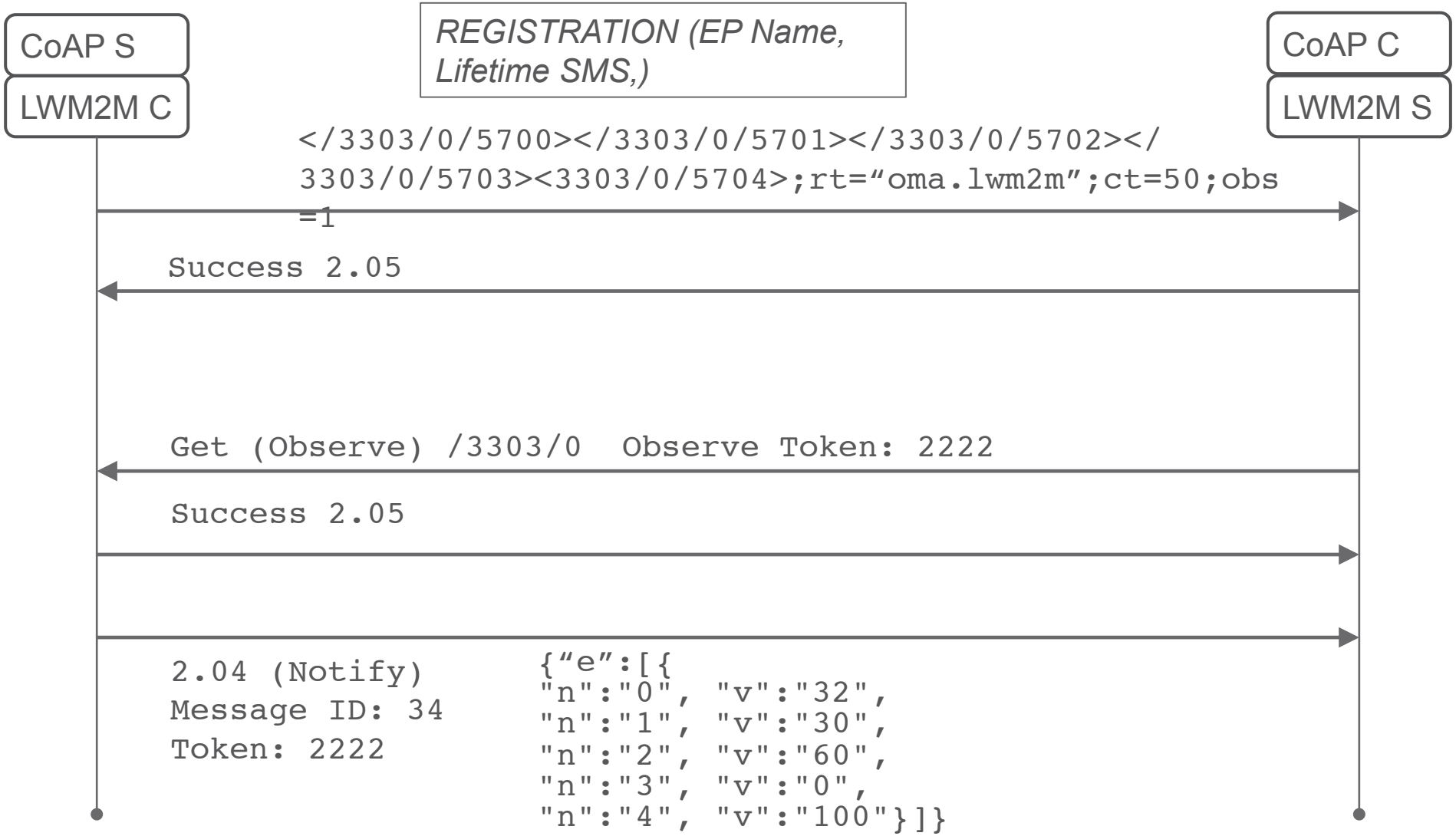
Object	Object ID	Object URN	Multiple Instances?
IPSO Barometer	315	urn:oma:lwm2m:ext:315	Yes

Resource Name	Resource ID	Access Type	Multiple Instances?	Type	Range or Enumeration	Units	Descriptions
Sensor Value	5700	R	No	Decimal		kPa	This resource type returns the air pressure Value in kPa
Min Measured Value	5601	R	No	Decimal		kPa	The minimum value measured by the sensor since it is ON
Max Measured Value	5602	R	No	Decimal		kPa	The maximum value measured by the sensor since it is ON
Min Range Value	5603	R	No	Decimal		kPa	The minimum value that can be measured by the sensor
Max Range Value	5604	R	No	Decimal		kPa	The maximum value that can be measured by the sensor

WASHING MACHINE EXAMPLE I



WASHING MACHINE EXAMPLE II



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Alliance

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