What problems are we trying to solve?

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Possible Goals

1. **End users** need descriptions of resources and actions in their language of choice for configuring if/then style rules.
2. **Administrators** need descriptions of resources and actions for configuring security policies.
3. **Standards orgs** need data models for review, publication, and potentially compliance testing / certification.
4. **Developers** need data models for manual or automated code generation
5. **Debugging tools** want them for generic object browsers, etc.
6. **Translators** want them for dynamic mapping to other protocols without a priori knowledge
7. **Devices** want them for discovery of meta-data and for driving interactions.
8. … others?

Many different solutions today for getting data models, with varying tradeoffs

- What form do you get it in:
  - Extracted from specification, or obtained directly in data model form?
- Where do you get it from:
  - A cloud repository? The vendor's site? A device itself?
- Does it all come in one piece or are there different pieces possibly from different places?
  - E.g., syntax vs end-user descriptions in language X vs developer-specific comments

Example: OMA & IPSO

OMA: LWM2M Schema

- Schema is used for was created to support handling Objects & Resources registrations.

- Schema can be found at:
  http://technical.openmobilealliance.org/tech/profiles/LWM2M.xsd

- This schema is NOT part of the OMA LightweightM2M v1.0 release, (LwM2M)

- The new LwM2M Objects and Resources editor, (eLwM2M Editor), is on trials. The plan is to release it at the end of March 16.

- Note: The schema needs an update as it still contains some problems.

OMA LwM2M Editor
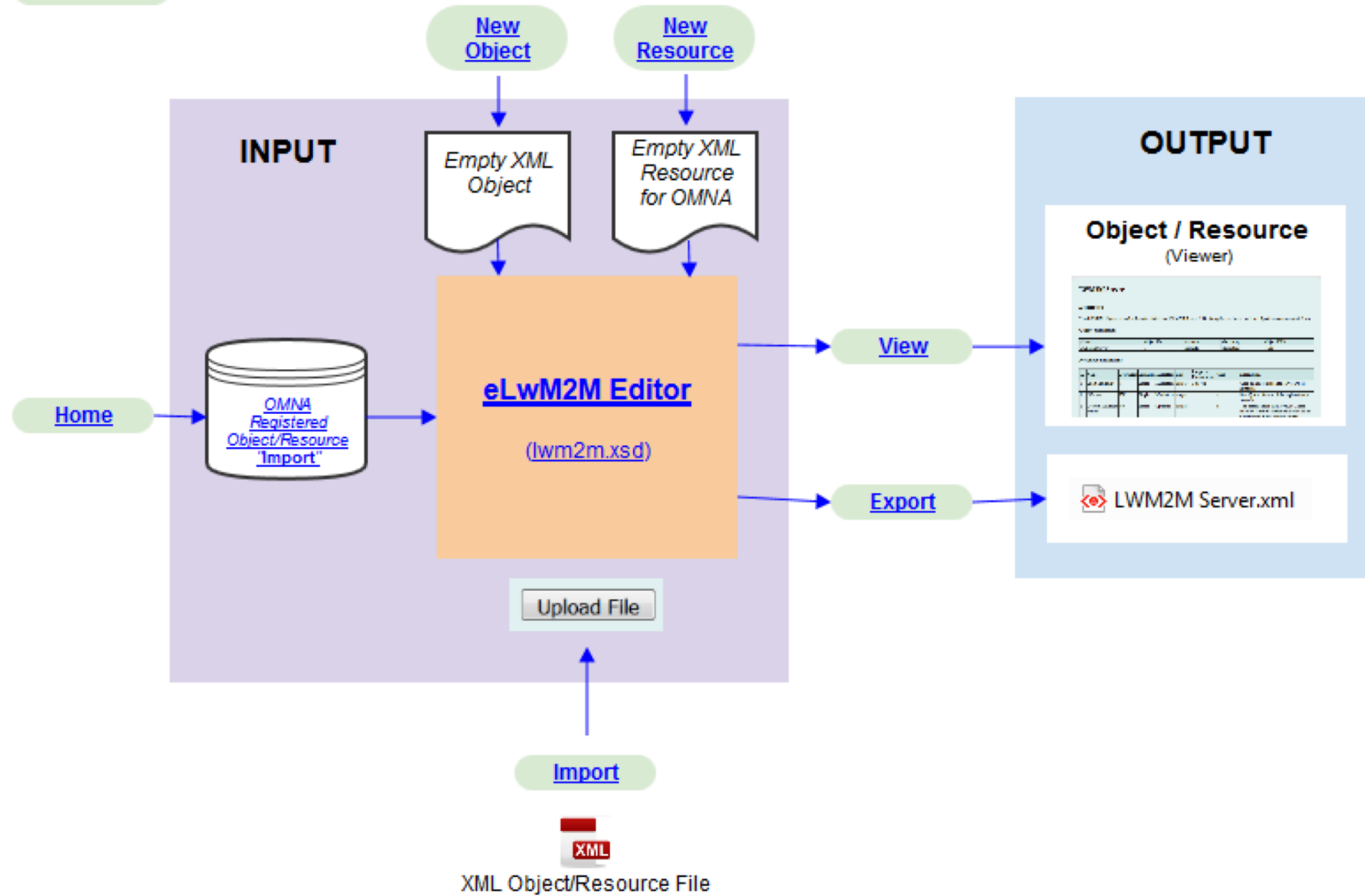
OMA LwM2M Editor

The Editor will:

- Create new Objects/Resources by input information into a table,
- Produce the xml file based on the content of the table,
- Allows to copy and past the newly created table into a OMA template or Word Document
  - This simplify the creation of new Object/Resources documents
- Download the newly created xml file
  - Well-formed and validated according to the lwm2m.xsd schema
- Import xml files into the tool
- Import OMA Object/Resources (registered with OMNA, OMA Naming Authority)

IPSO

- Re-uses LWM2M Object Model.
- Makes use of the OMA LWM2M schema for object/resource registrations to fulfill the requirements by OMA.

Humidity Sensor Example: Table Representation

Object	Object ID	Object URN	Multiple Instances?	Description
IPSO Humidity	3304	**urn:oma:lwm2m:ext:3304**	Yes	Relative humidity sensor, example units = %

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
Sensor Value	5700	R	No	Mandatory	Float			Last or Current Measured Value from the Sensor
Units	5701	R	No	Optional	String			Measurement Units Definition e.g. "Cel" for Temperature in Celsius.
Min Measured Value	5601	R	No	Optional	Float	Same as Measured Value	Same as Measured Value	The minimum value measured by the sensor since power ON or reset
Max Measured Value	5602	R	No	Optional	Float	Same as Measured Value	Same as Measured Value	The maximum value measured by the sensor since power ON or reset
Min Range Value	5603	R	No	Optional	Float	Same as Measured Value	Same as Measured Value	The minimum value that can be measured by the sensor
Max Range Value	5604	R	No	Optional	Float	Same as Measured Value	Same as Measured Value	The maximum value that can be measured by the sensor
Reset Min and Max Measured Values	5605	E	No	Optional	Opaque			Reset the Min and Max Measured Values to Current Value

XML representation available in position paper: https://www.iab.org/wp-content/IAB-uploads/2016/03/ipso-paper.pdf

Example: SenML

SenML - Too **Little** Meta Data

Consider
    {"e":[{ "n": "urn:dev:ow:10e2073a01080063", "v":23.5, "u":"Cel" }]}

We know the globally unique name of the sensor and it is a temperature of 23.5 degrees Celsius
We don't know the device type, OS version, manufacturer, which data model it uses or the access control lists. Yes, you might need that for some management but you don't need it for most use cases for a sensor
Goal is to cut it down to the bare minimum that still accomplishes many (but not all) use cases and is really simple to understand and use
The web, like IP, is successful because it started simple and easy

SenML - Too **Much** Meta Data

One might say:

> The name of the sensor and unit is duplicated meta data so why send it in every measurement? Get rid of the meta data and just send 23.5

Keeping the name and time allows the data to be stored in a schemaless DB and still processed. It allows many cache, aggregation, and filters to be applied.

It can increase performance for servers receiving millions of measurements to be able to handle the measurement in a stateless way

SenML tries to balance the meta data to make it easy for small simple devices with limited connectivity while being easy for large servers using current big data style tools

Example: W3C Thing Descriptions

W3C Thing Descriptions

- Thing descriptions can be used to create proxies for a thing, allowing scripts to interact with a local proxy for a remote entity

- Scripts can run on servers or as part of Web pages in Web browser for human machine interface
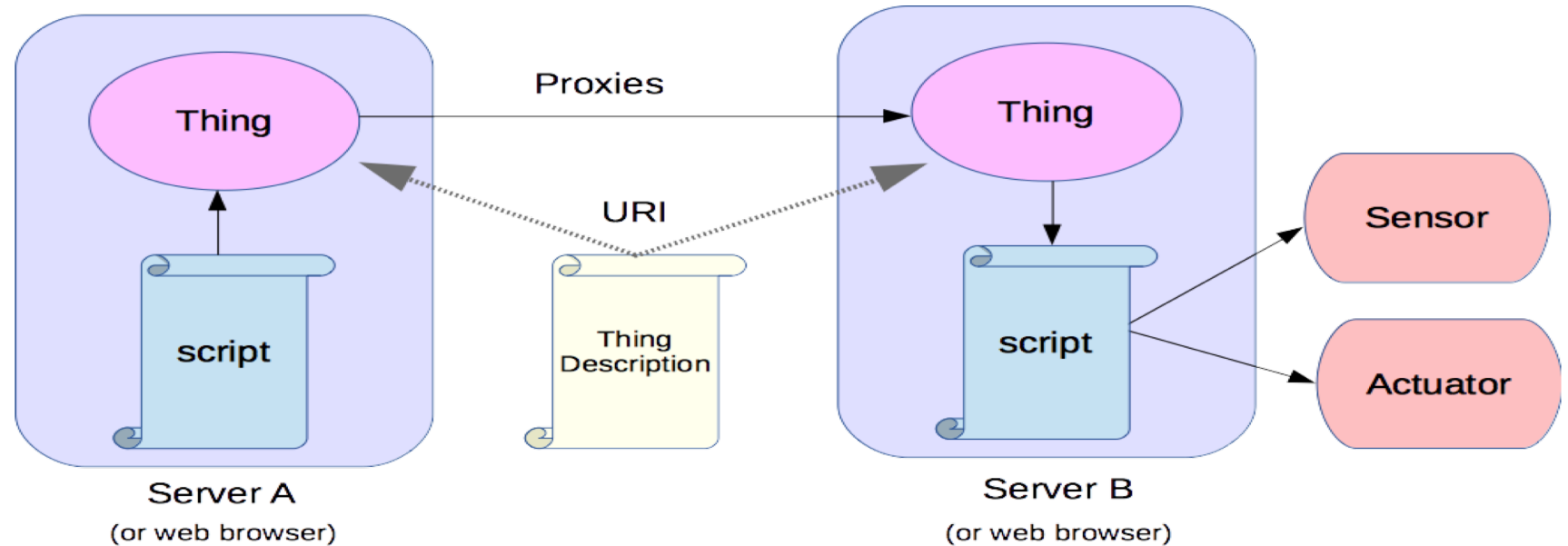
Summary

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   OMA/IPSO

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   Yang

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   Bluetooth Low Energy Characteristic Descriptors.

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   W3C Thing Descriptions, HATEOS, SenML