

Open APIs  
for Open  
Minds

# Data Models and Semantic IoP

A practical approach

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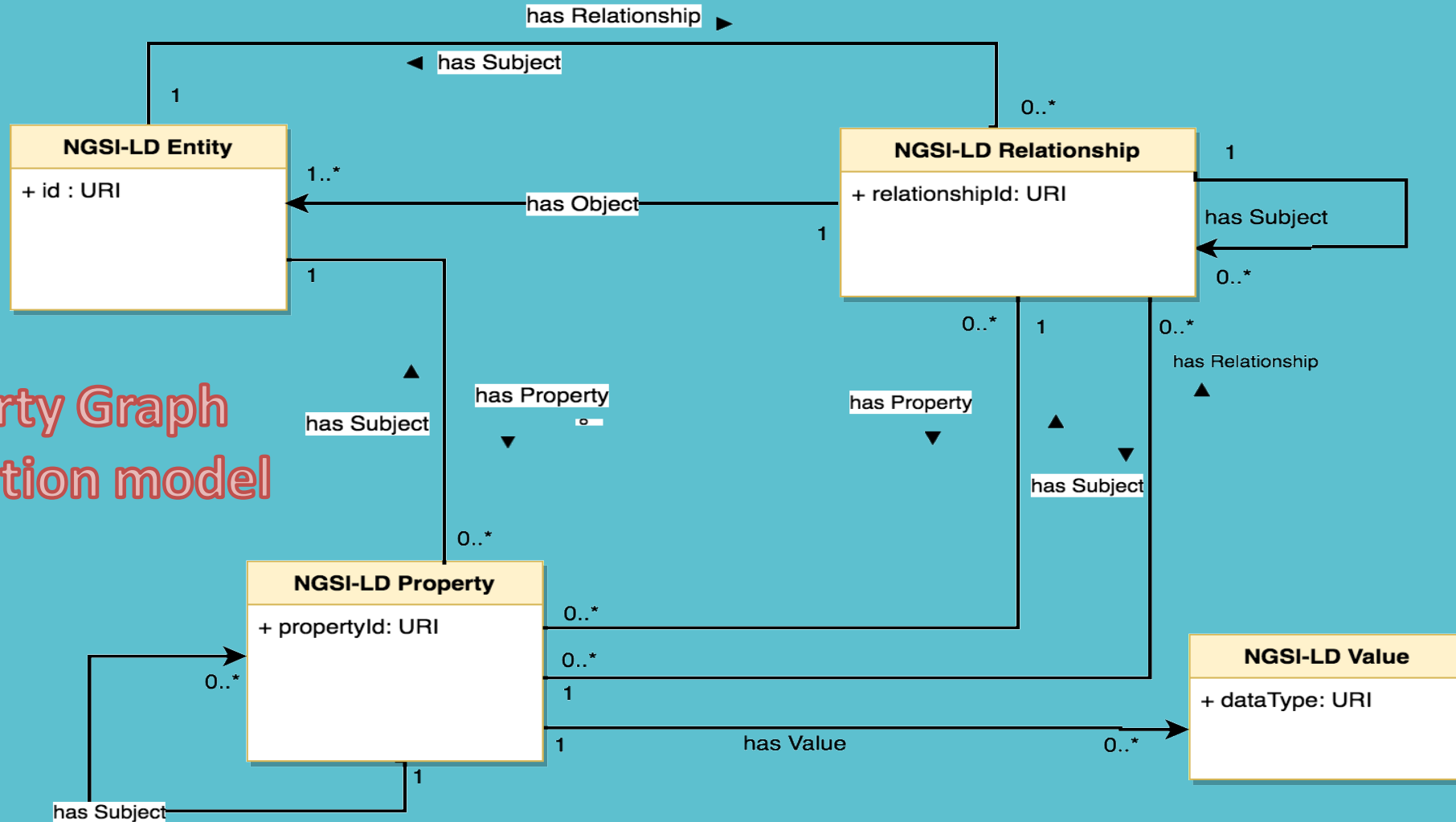
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# Semantic IoP @ Information Mgt. Layer



Property Graph  
Information model



# NGSI LD - Highlights

- **NGSI Entity** → Physical or virtual object.
  - It has (one) **Entity Type**.
  - Uniquely identified by an **Entity Id** (URI mandatory in NGSI-LD)
- Entity has zero or more **attributes** identified by a **name**
  - **Property** --> Static or dynamic intrinsic characteristic of an Entity
    - *GeoProperty* (geospatial context)
  - **Relationship** → Association with a Linked entity (unidirectional)
- Properties have a **value**
  - An NGSI value can be
    - single value (Number, String, boolean)
    - complex (Array, Structured Value)
- Relationships have an **object**
  - A URI which points to another entity (target of the relationship). Target can be a collection.





```
{
  "id": "urn:ngsi-ld:WasteContainer:A3456 ",
  "type": "WasteContainer",
  "fillingLevel": {
    "type": "Property",
    "value": 0.85,
    "observedAt": "2019-22-05T12:34:55Z",
  },
  "color": {
    "type": "Property",
    "value": "green"
  },
  "@context": [
    "https://schema.lab.fiware.org/ld/context",
    "https://uri.etsi.org/ngsi-ld/v1"
  ]
}
```

```
{
  "id": "urn:ngsi-ld:AirQualityObserved:Madrid:BG345",
  "type": "AirQualityObserved",
  "airQualityLevel": {
    "type": "Property",
    "value": "moderate"
  },
  "CO": {
    "type": "Property",
    "value": 500,
    "unitCode": "GP"
  },
  "temperature": {
    "type": "Property",
    "value": 12.2
  },
  "@context": [
    "https://schema.lab.fiware.org/ld/context",
    "https://uri.etsi.org/ngsi-ld/v1"
  ]
}
```

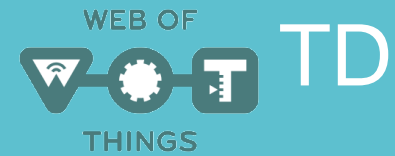
# FIWARE Data Models

- **Open source** project that has developed multiple data models
  - Mainly for the *smart city* domain
  - Specifications are crafted using **markdown + JSON Schema**
  - Example *Weather observed* data model
    - <https://github.com/Fiware/dataModels/blob/master/specs/Weather/WeatherObserved/doc/spec.md>
    - <https://fiware.github.io/dataModels/specs/Weather/WeatherObserved/schema.json>
- Data Models Guidelines (how to develop new Data Models)
  - <https://github.com/Fiware/dataModels/blob/master/specs/guidelines.md>
  - Pull Request – Review Lifecycle.
- Starting point for AgriFood Data Models (**GSMA IoT Big Data Project**)
  - <https://github.com/Fiware/dataModels/tree/master/specs/AgriFood>
  - Weather Data Models : WeatherObserved, WeatherForecast

# Data Model Standardization – FIWARE

- [Launched at the SCEWC'18 in Barcelona](#), joined by The cities of Vienna (Austria), Nice, Saint Quentin (France), Genoa (Italy), Utrecht (Netherlands), Porto (Portugal) Santander, Valencia (Spain), Gothenburg (Sweden), La Plata (Argentina), Montevideo (Uruguay), with an open invitation to other cities to join (Eindhoven joined soon afterwards)
- Specifications, ***based on FIWARE Data Models***, will be considered stable as soon as enough cities have validated them in practice (driven-by-implementation process).
- Stable specifications will become TM Forum formal deliverables following TM Forum's defined processes

# Semantic IoP @ IoT Device Layer .-



```
{
  "id": "urn:dev:ops:32473-WoT-ContainerSensor-1234",
  "name": "Sensor-Brand-Model",
  "securityDefinitions": {
    "nosec_sc": {
      "scheme": "nosec"
    }
  },
  "security": [
    "nosec_sc"
  ],
  "events": {
    "fillingValue": {
      "@type": "sosa:Observation",
      "sosa:hasFeatureOfInterest": "urn:ngsi-ld:WasteContainer:A3456",
      "sosa:observedProperty": "https://uri.fiware.org/ns/dataModels/fillingLevel",
      "data": {
        "type": "number"
      },
      "forms": [
        {
          "href": "mqtt://192.168.1.187:1883/WasteContainer/1234",
          "contentType": "text/plain"
        }
      ]
    }
  },
  "@context": [
    "https://www.w3.org/2019/wot/td/v1",
    {
      "sosa": "http://www.w3.org/ns/sosa/"
    }
  ]
}
```

W3C SSN Annotations  
for NGSI-LD Mapping

Event Mapping

```
{
  "id": "urn:ngsi-ld:WasteContainer:A3456",
  "type": "WasteContainer",
  "fillingLevel": {
    "type": "Property",
    "value": 0.85,
    "observedAt": "2019-22-05T12:34:55Z",
    "source": "urn:dev:ops:32473-WoT-ContainerSensor-1234"
  },
  "color": {
    "type": "Property",
    "value": "green"
  },
  "@context": [
    "https://schema.lab.fiware.org/ld/context",
    "https://uri.etsi.org/ngsi-ld/v1"
  ]
}
```

# References

- NGSI-LD Specification (January 2019)
  - [https://www.etsi.org/deliver/etsi\\_gs/CIM/001\\_099/009/01.01.01\\_60/gs\\_CIM009v010101p.pdf](https://www.etsi.org/deliver/etsi_gs/CIM/001_099/009/01.01.01_60/gs_CIM009v010101p.pdf)
- FIWARE Data Models
  - <https://github.com/FIWARE/dataModels>
- W3C WoT TD Specification (CR May 2019)
  - <https://www.w3.org/TR/wot-thing-description/>
- ETSI SAREF Ontology
  - <http://ontology.tno.nl/saref/>
- W3C SSN Ontology
  - <https://www.w3.org/TR/2017/REC-vocab-ssn-20171019/>



# Thank you!



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