# W3C Workshop on Web Standardization for Graph Data

## Position Statement from ETSI ISG CIM

Contributors (and agreed by ETSI ISG CIM):

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## Introduction

This position statement outlines the consensus view of the ETSI ISG CIM Group on Web Standardization for Graph Data. ETSI ISG CIM is an Industry Specification Group on Context Information Management. The goal of ETSI ISG CIM is to develop technical specifications and reports to enable multiple organisations to develop interoperable software implementations of a cross-cutting Context Information Management (CIM) Layer.

A Context Information Management system offers a clearing-house for publishing, discovering, monitoring and manipulating the data which has the right context for an application. The primary goal is to allow interoperability, as well as rapid and scalable operations. Context Information Management (also sometimes known as Context Brokering) has emerged - along with the management of the primary data - as a source of additional functionalities for data analysis and knowledge discovery. With the rapid development of technologies such as Big Data, Semantic Web, complex workflow, autonomous decision making, etc., the need for interoperable context brokering has increased massively in the past few years.

NGSI-LD API is a Group Specification developed by ETSI ISG CIM, intended to define a core information model and accompanying API to provide, consume and subscribe to context information in multiple scenarios and involving multiple stakeholders. It enables close to real-time access to information coming from many different sources (not only IoT).

## NGSI-LD Information Model

Figure 1 shows an RDF/RDFS based definition diagram of the NGSI-LD information model.

In the NGSI-LD information model, there are Entities, Properties and Relationships. Entities (instances) can be the subject of other Properties or Relationships. Properties can be seen as the combination of an attribute (property) and its value. Relationships allow establishing "links" between instances using JSON-LD conventions. In practice, they are attributes, but with a special value (named object) which happens to be a URI which points to another entity residing in the same system or externally.

Properties and Relationships can be the subject of other Properties or Relationships, which is made feasible by the definition of the NGSI-LD meta-model described in following diagram.
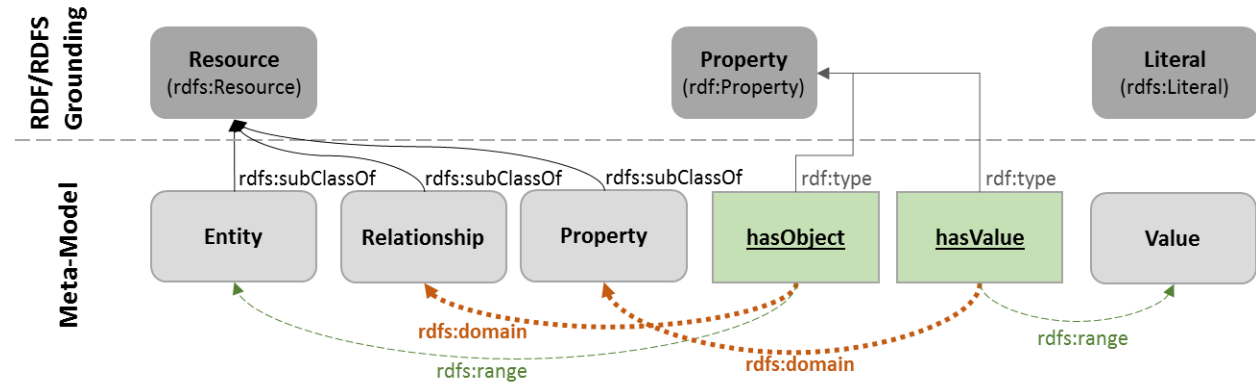


Figure 1 - The NGSI-LD Information Model

Figure 2 shows an instantiation example of the NGSI-LD information model. It conveys that there is an instance of an entity of type *Vehicle* which is parked at a certain parking garage (entity of type *OffStreetParking*). Different properties of these entities are provided and additional properties of properties or properties of relationships are described.
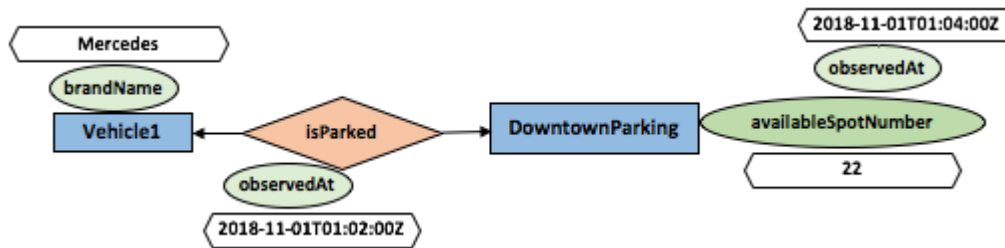


Figure 2 - NGSI-LD Instantiation

Figure 3 shows the JSON-LD representation of the Entities conveyed in Figure 2.

```
{
  "id": "urn:ngsi-ld:OffStreetParking:DowntownParking",
  "type": "OffStreetParking",
  "availableSpotNumber": {
    "type": "Property",
    "value": 22,
    "observedAt": "2018-11-01T01:02:00Z"
  },
  "@context": [
```

```
    "http://uri.etsi.org/ngsi-ld/v1/coreContext.jsonld",
    "http://example.org/ngsi-ld/parking.jsonld"
  ]
}

{
  "id": "urn:ngsi-ld:Vehicle:Vehicle1",
  "type": "Vehicle",
  "brandName": {
    "type": "Property",
    "value": "Mercedes"
  },
  "isParked": {
    "type": "Relationship",
    "object": "urn:ngsi-ld:OffStreetParking:DowntownParking",
    "observedAt": "2018-11-01T01:04:00Z"
  },
  "@context": [
    "http://uri.etsi.org/ngsi-ld/v1/coreContext.jsonld",
    "http://example.org/ngsi-ld/vehicle.jsonld"
  ]
}
```

Figure 3 - JSON-LD Representation

## Our Position

We made a contribution that demonstrates the feasibility of representing property graphs in JSON-LD. Property graphs require being able to express properties about relations, which corresponds to making statements about triple-based statements in RDF. As the RDF triple structure does not allow attaching information directly to properties or complete statements, some form of reification is required.

There are different approaches for reification in RDF, which each have their pros and cons. We have chosen to use the approach based on blank nodes to which additional information can be attached. When using a JSON-LD representation, the blank nodes are not directly visible, so this additional structural element can be hidden. We consider this to be a developer-friendly representation, as the developer is not bothered with elements only required for structural reasons. However, when using some other RDF serializations for the same information, they have to be explicitly represented.

Consider the property graph example in Figure 4 describing the state of a parking place. The state property itself is described with a modification date that happened in the system.



Figure 4 – Parking Space as Property Graph

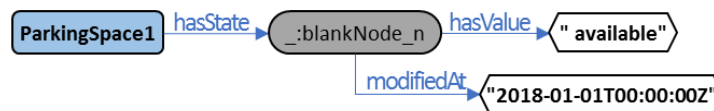This example can be represented in RDF (Figure 5), using blank-node reification, as follows:



Figure 5 – Parking Space in RDF Representation

Unlike in the RDF representation, when expressed in JSON-LD, the blank-node will not be explicitly represented (as shown in the JSON-LD example in the previous section), rather it is natural according the JSON-LD serialization. This corresponds to our meta model as shown in Figure 6.
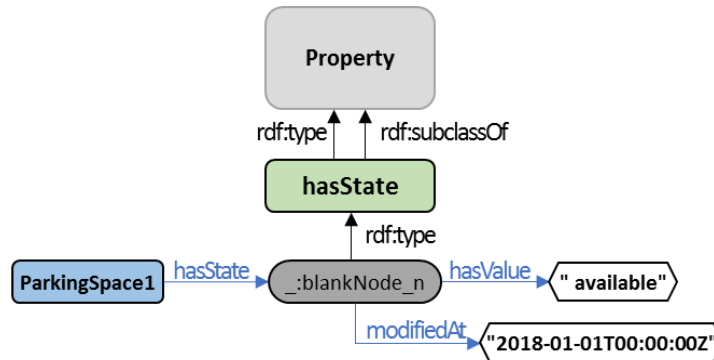


Figure 6 – Parking Space Linked to Meta Model

W3C should consider standardizing an approach that allows attaching additional information to triples in a more straightforward way, so property graphs can be mapped to RDF directly. When doing so, a developer-friendly representation in JSON-LD should be adopted.

## About ETSI ISG CIM

ETSI ISG CIM is an Industry Specification Group on Context Information Management. The goal of ETSI ISG CIM is to develop technical specifications and reports to enable multiple organisations to develop interoperable software implementations of a cross-cutting Context Information Management (CIM) Layer.

The current number of participants is around 25 with a wide diversity of organizations (Telecom operators, Cloud Service Providers, Research groups, etc.). The ETSI ISG CIM is expected to run at least until 2020.

## References

NGSI-LD Specification for Public Review
https://docbox.etsi.org/ISG/CIM/Open/ISG_CIM_NGSI-LD_API_Draft_for_public_review.pdf

JSON-LD RDF API: JSON-LD API extensions for transforming to RDF
https://json-ld.org/spec/latest/json-ld-rdf/

## Acknowledgements