

FIWARE
**Global
Summit**

Introduction to JSON-LD and Linked Data

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Vienna, Austria
12-13 June, 2023
#FIWARESummit

**From Data
to Value**

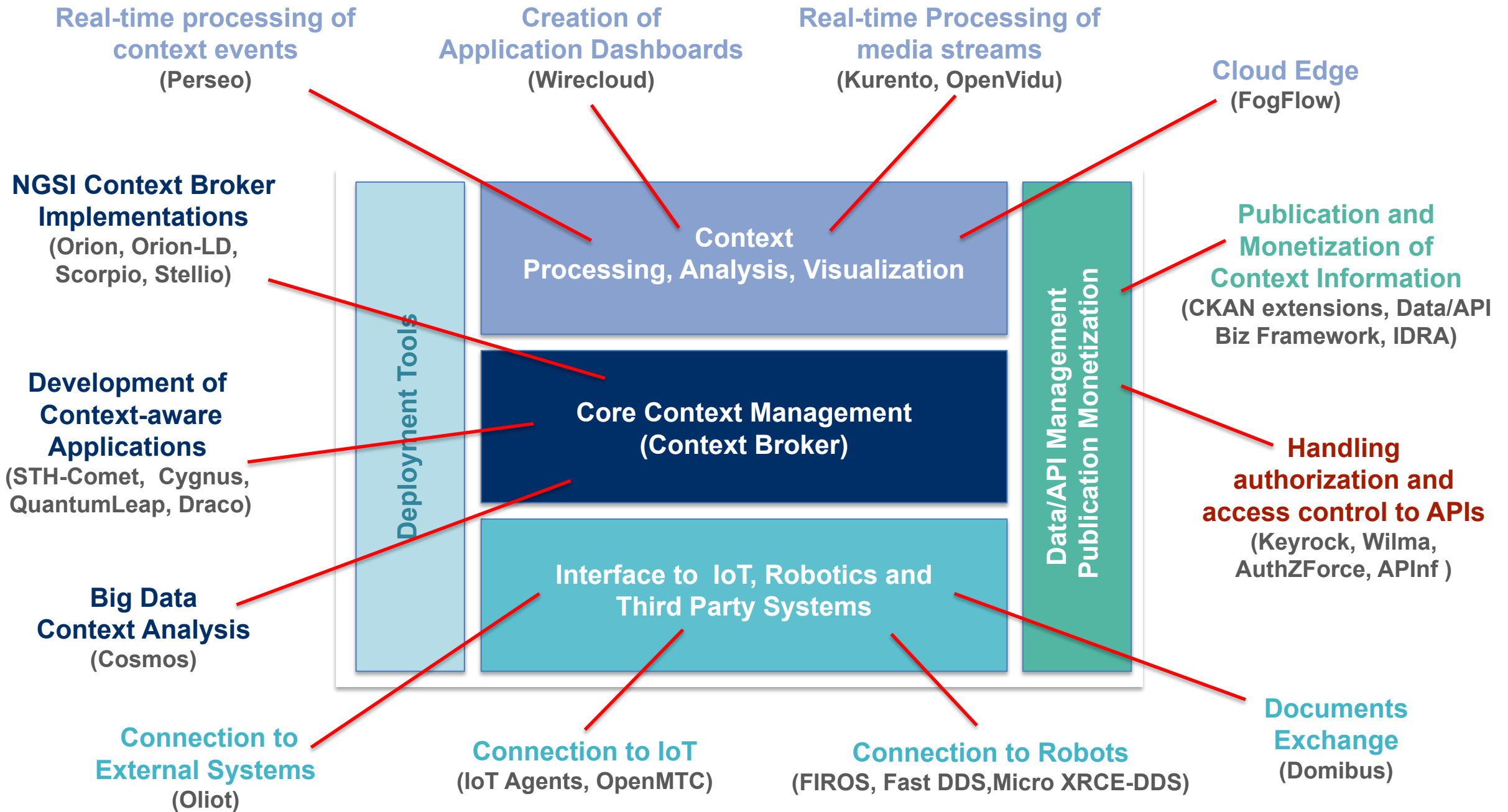
OPEN SOURCE
OPEN STANDARDS
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FIWARE in a nutshell

FIWARE is an open-source initiative defining a universal set of standards for **context data management** which facilitate the development of **smart solutions**.

- REST done right
- Standard mapping of HTTP verbs and status codes
- JSON payloads plus some additional structure rules
- Registrations to augment context
- Publish/Subscribe mechanism for asynchronous processing



NGSI v2 already exists, why bother with NGSI-LD?

I like the idea of:

- No vendor lock-in
- Adding an interoperability layer between processes and the real world
- Flexible architectures
 - *Powered by FIWARE Solutions*
 - *FIWARE Ready Devices*
 - *FIWARE Ready Enablers*
 - etc.

I've already gained those advantages, so what comes next?

My data is useful to me, but is more powerful shared with others

... but what about Conway's law?

Any organization that designs a system (defined broadly) will produce a design whose structure is a copy of the organization's communication structure.

— Melvin E. Conway

... how can I share data and benefit from other organizations if their organization “*communicates*” differently?

Illustrative FIWARE Examples



Car Parking



**Cross-border
Tourism**



Linked Data: JSON to JSON-LD

From: <https://json-ld.org/> {🔗}

- **JSON-LD** is a lightweight Linked Data format. It is easy for humans to read and write. It is based on the already successful JSON format and provides a way to help JSON data interoperate at Web-scale.
- **Linked Data** empowers people that publish and use information on the Web. It is a way to create a network of standards-based, machine-readable data across Web sites. It allows an application to start at one piece of Linked Data and follow embedded links to other pieces of Linked Data that are hosted on different sites across the Web.


```
{
  "@context": "https://json-ld.org/contexts/person.jsonld",
  "@id": "http://dbpedia.org/resource/John_Lennon",
  "name": "John Lennon",
  "born": "1940-10-09",
  "spouse": "http://dbpedia.org/resource/Cynthia_Lennon"
}
```



Harpreet Singh, the Blockchain in Smart Cities Expert





Harpreet Singh
Director of Sales & Marketing at
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URL: <https://www.linkedin.com/in/singhhp1069/>



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Linked Data: NGSI v2 to NGSI-LD

From: https://fiware-datamodels.readthedocs.io/en/latest/ngsi-ld_faq/index.html

- **NGSI-LD** is an evolution of the FIWARE NGSI v2 information model, and has been updated/improved to support linked data (entity relationships), property graphs and semantics (exploiting the capabilities offered by JSON-LD). This work has been conducted under the ETSI ISG Context Information Management initiative.

```
{
  "@context": [
    "https://fiware.github.io/data-models/context.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context.jsonld"
  ],
  "id": "http://dbpedia.org/resource/John_Lennon",
  "type": "Person",
  "name": {"type": "Property", "value": "John Lennon"},
  "born": {"type": "Property", "value": "1940-10-09"},
  "spouse": {"type": "Relationship", "object": "http://dbpedia.org/resource/Cynthia_Lennon" }
}
```

- Creating proper machine-readable Linked Data is **fundamental** to NGSI-LD.
- **NGSI-LD** Payloads are valid **JSON-LD**

NGSI-LD Properties: Creating an Entity

NGSI v2

```
curl -iX POST 'http://localhost:1026/v2/entities' \
-H 'Content-Type: application/json' \
-d '{
  "type": "Store", "id": "store001",
  "category": { "type": "Array", "value": ["commercial"]},
  "address": { "type": "PostalAddress", "value": {
    "streetAddress": "Bornholmer Straße 65",
    "addressRegion": "Berlin",
    "addressLocality": "Prenzlauer Berg",
    "postalCode": "10439"
  }},
  "metadata": {
    "verified": { "type": "Boolean", "value": true}
  }
},
"location": { "type": "geo:json",
  "value": { "type": "Point", "coordinates": [13.3986, 52.5547]}
},
"name": { "type": "Text", "value": "Bösebrücke Einkauf"
}'
```

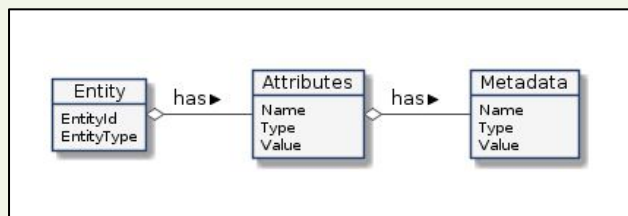
NGSI-LD

```
curl -iX POST http://localhost:1026/ngsi-ld/v1/entities \
-H 'Content-Type: application/ld+json' \
-d '{
  "type": "Building", "id": "urn:ngsi-ld:Building:store001",
  "category": {
    "type": "VocabularyProperty",
    "vocab": ["commercial"]
  },
  "address": { "type": "Property", "value": {
    "streetAddress": "Bornholmer Straße 65",
    "addressRegion": "Berlin",
    "addressLocality": "Prenzlauer Berg",
    "postalCode": "10439"
  }},
  "verified": { "type": "Property", "value": true }
},
"location": { "type": "GeoProperty",
  "value": { "type": "Point", "coordinates": [13.3986, 52.5547]}
},
"name": { "type": "Property", "value": "Bösebrücke Einkauf" },
"@context": [
  "https://fiware.github.io/data-models/context.jsonld",
  "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context.jsonld"
]
}'
```

NGSI-LD Properties: Data Model

The NGSI LD data model is more complex; the definitions of use are more rigid which lead to a navigable knowledge graph.

NGSI v2

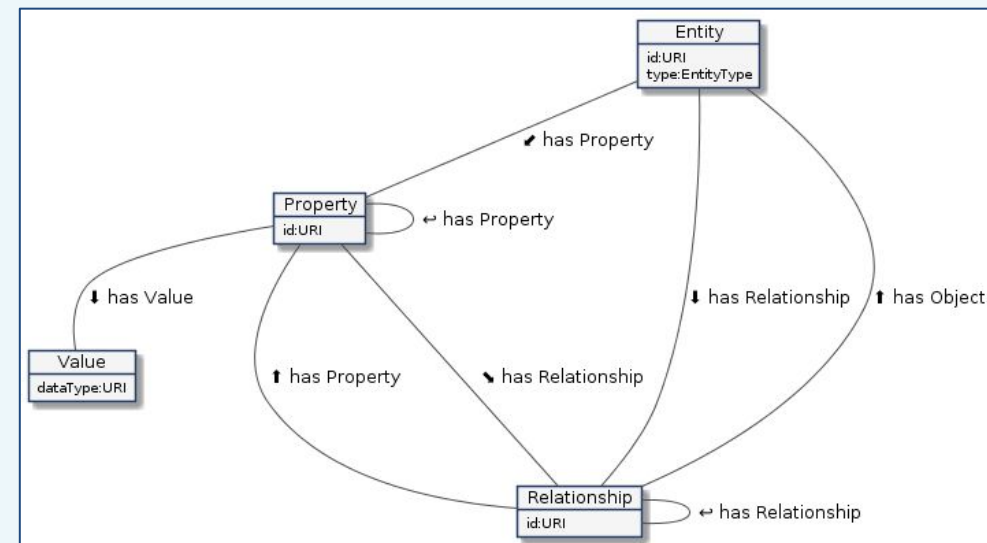


- Entities
- Attributes
- MetaData

NGSI-LD

- Entities
- Properties
- Relationships
- Values

plus ...



- Properties of Properties
- Properties of Relationships
- Relationships of Properties
- Relationships of Relationships

etc...

- Properties of Properties of Properties
- Relationships of Properties of Properties
- Properties of Properties of Relationships
- Relationships of Properties of Relationships
- Properties of Relationships of Properties
- Relationships of Relationships of Properties
- Properties of Relationships of Relationships
- Relationships of Relationships of Relationships

NGSI-LD Properties: Data Model

The Entity	Example	Notes
Has an id	<code>urn:ngsi-ld:Building:store001</code>	URI/URN. id must be unique.
Has a type .	<code>https://uri.fiware.org/ns/data-models#Building</code>	<ul style="list-style-type: none">Fully qualified URI of a well defined data modelShort-hand strings for types, mapped to fully qualified URIs through the JSON-LD @context.
Has a series of properties	name, address, category etc.	This can be expanded into <code>http://schema.org/address</code> , which is known as a fully qualified name (FQN).
Has a series of properties-of-properties	a verified field for the address	This is the equivalent of NGSI v2 metadata
Has a series of relationships	managedBy	The object corresponds to the URI/URN of another data entity. Equivalent of NGSI v2 refXXX
Has a series of properties-of-relationships	managedBy.since	Holds additional information about a relationship. This is the equivalent of metadata about a refXXX property
Has a series of relationships-of-relationships	managedBy.subordinateTo	holds the URI/URN of another relationship.

NGSI-LD Properties: Reading Entity Data

NGSI-LD

```
curl -G -X GET \
'http://localhost:1026/ngsi-ld/v1/entities' \
-H 'Link: <https://fiware.github.io/data-models/context.jsonld>;
rel="http://www.w3.org/ns/json-ld#context";
type="application/ld+json"' \
-H 'Accept: application/ld+json' \
-d 'type=Building' \
-d 'options=keyValues'
```

- Response is just a JSON payload plus an `@context`
- `@context` can be passed either in the `Link` header or the payload body:
 - `Accept: application/ld+json` to include the `@context` as a JSON attribute
 - `Accept: application/json` returns plain old JSON objects - `@context` is passed as a Link header
- Just a minute what has happened to `category`?

```
[
  {
    "@context": "https://fiware.github.io/data-models/context.jsonld",
    "id": "urn:ngsi-ld:Building:store001", "type": "Building",
    "address": {
      "streetAddress": "Bornholmer Straße 65",
      "addressRegion": "Berlin",
      "addressLocality": "Prenzlauer Berg",
      "postalCode": "10439"
    },
    "name": "Bösebrücke Einkauf",
    "category": [
      "https://uri.fiware.org/ns/data-models#commercial"
    ],
    "location": {
      "type": "Point", "coordinates": [13.3986, 52.5547]
    }
  }
]
```

NGSI-LD Properties: What to call a location?

- location
- locatedAt
- geocoordinate
- geocoordinates
- place
- ubicación
- standort
- 置き場所

NGSI-LD core **@context**

```
"@context": {  
  "ngsi-ld": "https://uri.etsi.org/ngsi-ld/",  
  "id": "@id",  
  "type": "@type",  
  "value": "https://uri.etsi.org/ngsi-ld/hasValue",  
  "object": {  
    "@id": "https://uri.etsi.org/ngsi-ld/hasObject",  
    "@type": "@id"  
  },  
  "Property": "https://uri.etsi.org/ngsi-ld/Property",  
  "Relationship": "https://uri.etsi.org/ngsi-ld/Relationship",  
  ... etc.  
  "unitCode": "https://uri.etsi.org/ngsi-ld/unitCode",  
  "location": "https://uri.etsi.org/ngsi-ld/location",  
  ... etc.  
}
```

With NGSI-LD core **@context** a location is **always**
<https://uri.etsi.org/ngsi-ld/location>

NGSI-LD Properties: **@vocab** and Enumerated Values

With NGSI-LD Data Models, attributes and enums are well-defined in a computer-readable fashion

FIWARE Data Models **@context**

```
"@context": {  
  "type": "@type",  
  "id": "@id",  
  "schema": "https://schema.org/",  
  "fiware": "https://uri.fiware.org/ns/data-models#",  
  ... etc.  
  "address": "schema:address",  
  "category": "fiware:category",  
  "commercial": "fiware:commercial",  
  "office": "fiware:office",  
  "retail": "fiware:retail",  
  "residential": "fiware:residential",  
  ... etc.  
}
```

- An “address” is a **Property**:
<https://schema.org/address>
- A “category” is a **VocabularyProperty**:
<https://uri.fiware.org/ns/data-models#category>
- **VocabularyProperty** is defined in the NGSI-LD specification v1.7.1 and takes a set of **vocab** values such as:
<https://uri.fiware.org/ns/data-models#commercial>
<https://uri.fiware.org/ns/data-models#office>
<https://uri.fiware.org/ns/data-models#retail>
<https://uri.fiware.org/ns/data-models#residential>

Useful links

JSON-LD

- Website: <https://json-ld.org/>
- Linked Data Video: <https://www.youtube.com/watch?v=vioCbTo3C-4>
- JSON-LD Video: https://www.youtube.com/watch?v=4x_xzT5eF5Q

NGSI-LD

- ETSI Specification:
https://www.etsi.org/deliver/etsi_gs/CIM/001_099/009/01.06.01_60/gs_CIM009v010601p.pdf
- NGSI-LD Video: <https://www.youtube.com/watch?v=rZ13lyLpAtA>
- Tutorials: <https://ngsi-ld-tutorials.readthedocs.io/>

Smart Data Models

- Website: <http://smartdatamodels.org/>
- Smart Cities Data Models Video: <https://www.youtube.com/watch?v=dfMo0HnaIUQ>



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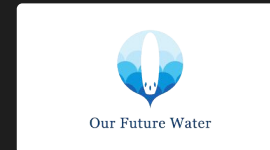
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