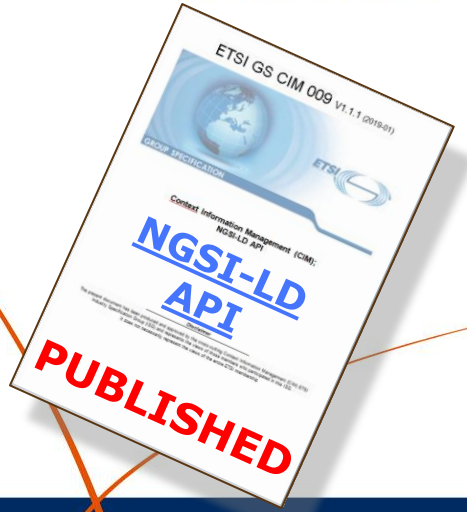
Orchestrating a brighter world

NEC

SDI.Next: Linked Spatial Data in Europe

Context Information Management at ETSI ISG CIM using NGSI-LD and Property Graphs



12th March 2019, Martin Bauer
NEC Laboratories Europe

Note: Slides in ETSI Layout have been officially agreed in ETSI ISG CIM;
Slides in NEC Layout represent the point of view of the presenter

This activity has partially received funding by the European Commission (Horizon 2020 grant agreement No. 731993 (Autopilot).

AUTOPILOT

Overview

- Mission of ETSI ISG CIM
- NGSI-LD Information Model
- NGSI-LD API
- NGSI-LD Data Models from different Domains
- NGSI-LD Usage: FIWARE Generic Enablers

MISSION OF ETSI ISG CIM

ETSI & ETSI ISG CIM

European Telecommunications Standards Institute (ETSI)

- ETSI produces globally-applicable standards for Information and Communications Technologies (ICT)
- It is officially recognized by the European Commission as a European Standards Organization
- Industry Specification Groups (ISG) allow participation of non-ETSI-members

ETSI ISG for cross-cutting Context Information Management (ETSI ISG CIM)

- Established in 2017 for duration of two years
- Recently extended for two more years until 2021
- Chairman: Lindsay Frost (NEC)
- Currently 22 Members (= ETSI Members) + 8 Participants
- **Evolution of NGSI Context Interfaces → NGSI-LD**

ETSI ISG CIM: Mission

… to make it easier

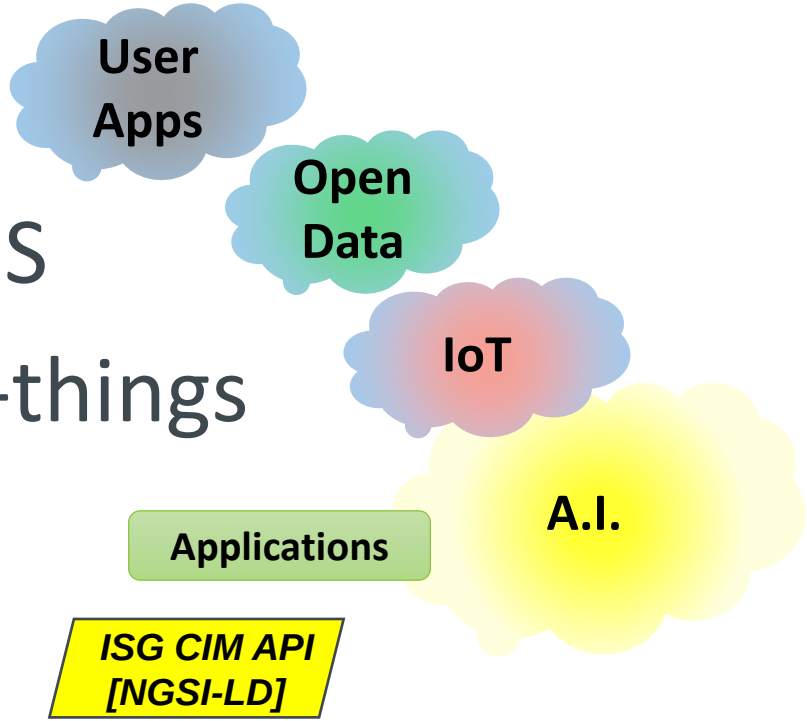
for END-USERS

and CITY DATABASES

and IoT internet-of-things

and 3rd-party APPS

to exchange INFO



Context Information Management: exchange data AND definitions (ontology)

User Apps

Simple coding!

A.I.

APPs

Highly diverse databases

Open Data

Context Information Management

Provenance

Usage

High data rate

Ontology re-use

Restricted access

IoT

Proprietary Data

Solve the issues

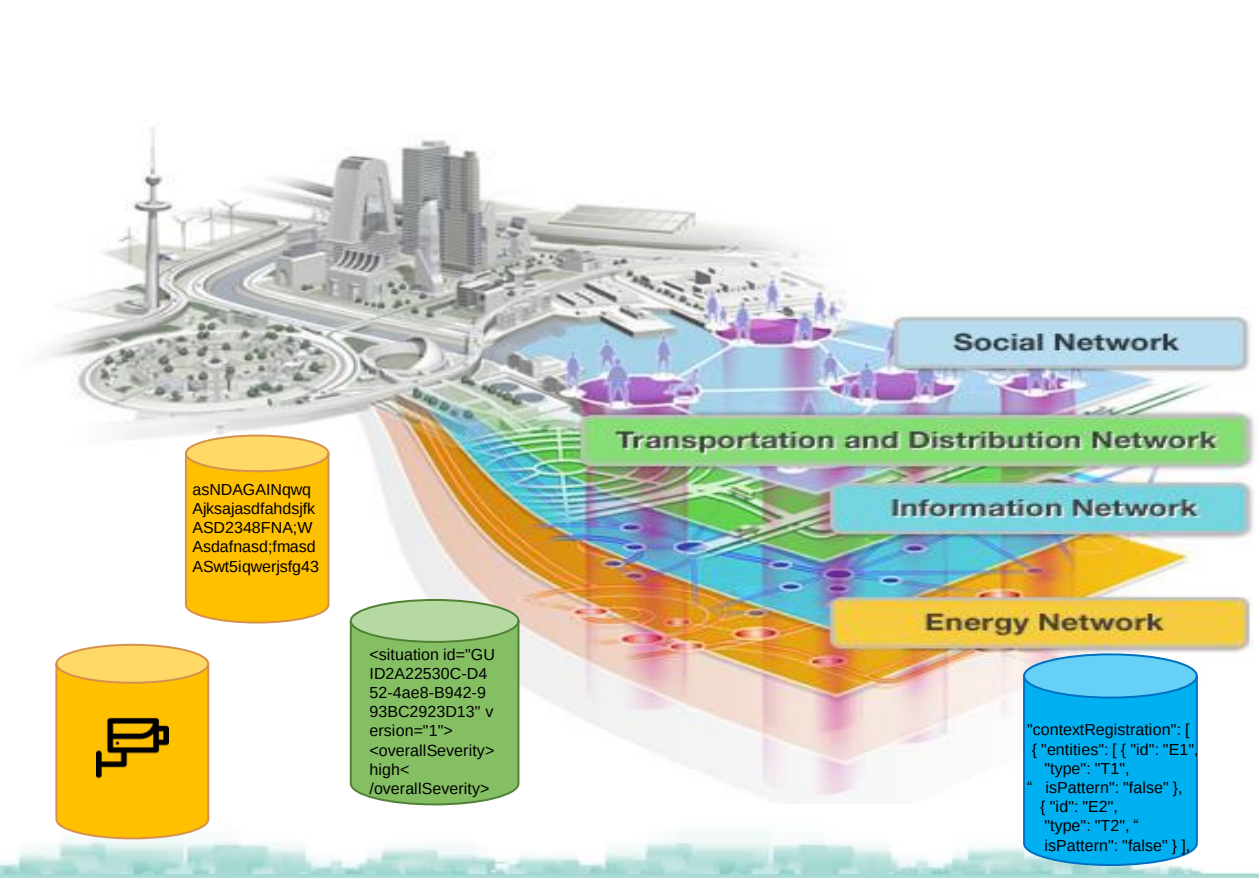
High-Level Design Goals of NGSI-LD

- *Evolution of OMA/FIWARE NGSI Context Interfaces*
- Put NGSI-LD Information Model on a solid conceptual grounding
  - Property graph model
  - Enable semantic concept definitions
  - Enable linking to existing information

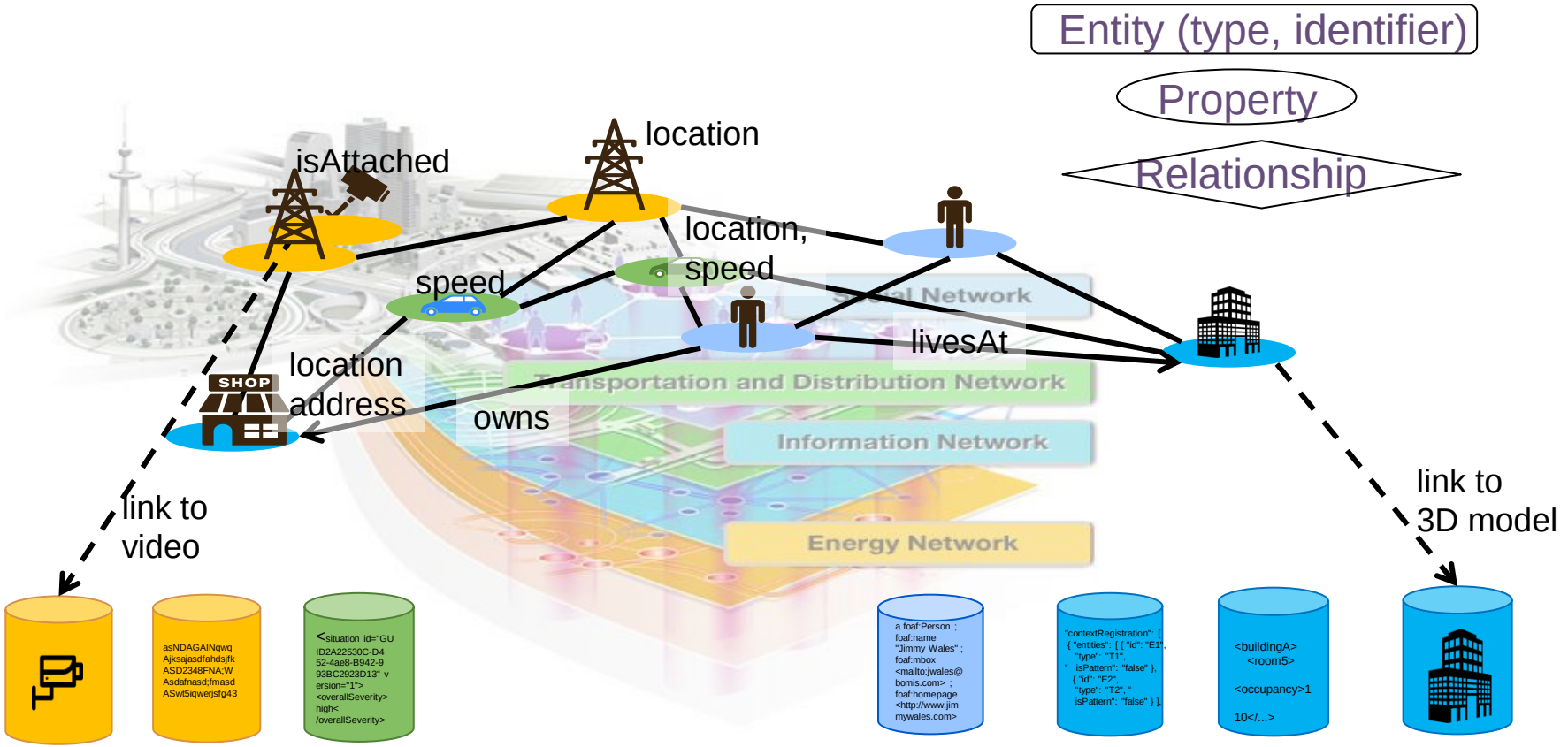
  } **Linked Data**
- Enable applications to specify WHAT information they require (based on the NGSI-LD Information Model) – including *geographic scoping* and temporal interface
- Support central as well as distributed and federated NGSI-LD system architectures with arbitrary information distribution

NGSI-LD INFORMATION MODEL

Use Case Example: Smart City Information



NGSI-LD Information Model



All clipart is under Creative Commons BY 4.0 Licence from https://www.svgrepo.com

NGSI-LD Information Model

NGSI Entity → Physical or virtual object.

- It has (one) Entity Type.
- Uniquely identified by an Entity Id (URI)

Entity has zero or more attributes identified by a name

- Property --> Static or dynamic characteristic of an entity
  - GeoProperty (geospatial context)
  - TemporalProperty (time context)
- Relationship → Association with a Linked entity (unidirectional)

Properties have a value

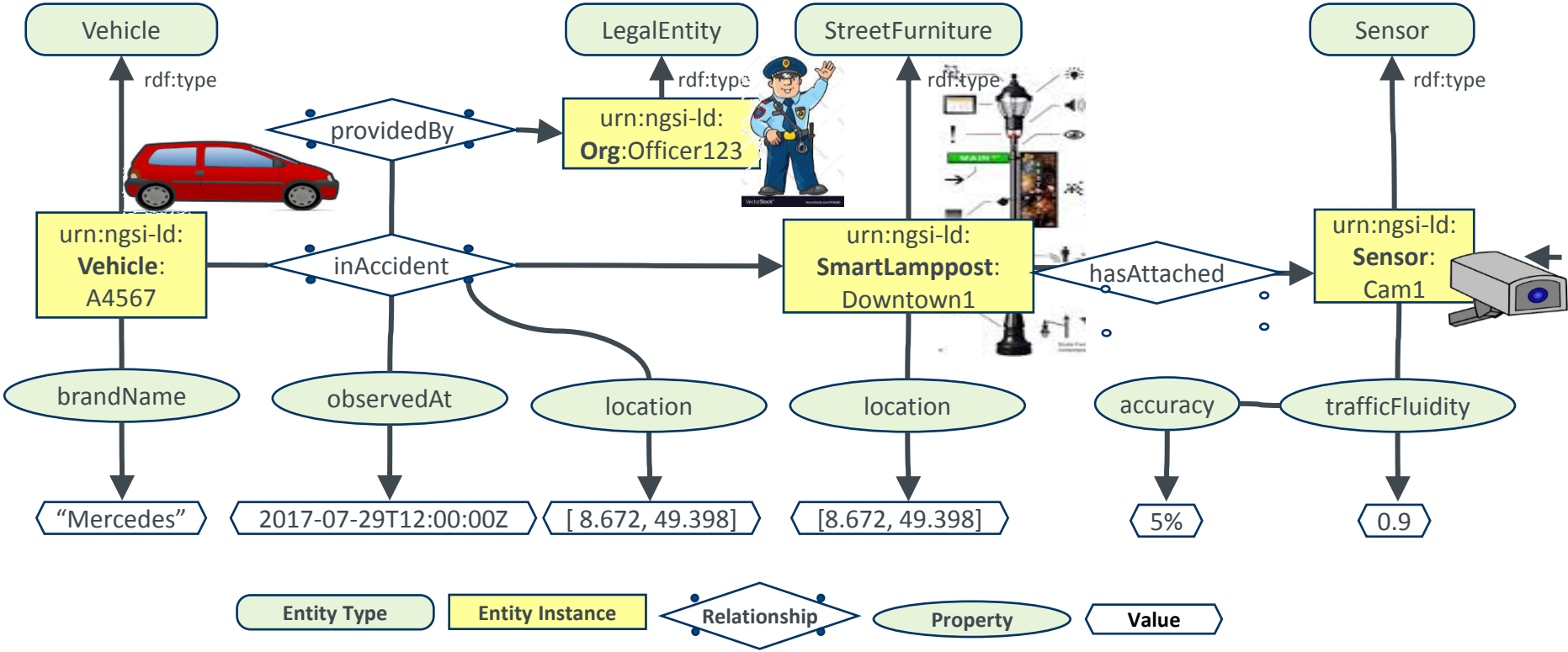
- Can be a single value (Number, String, boolean), or complex (Array, Structured Value)

Relationships have an object

- A URI pointing to another entity (target of the relationship). Target can be a collection.

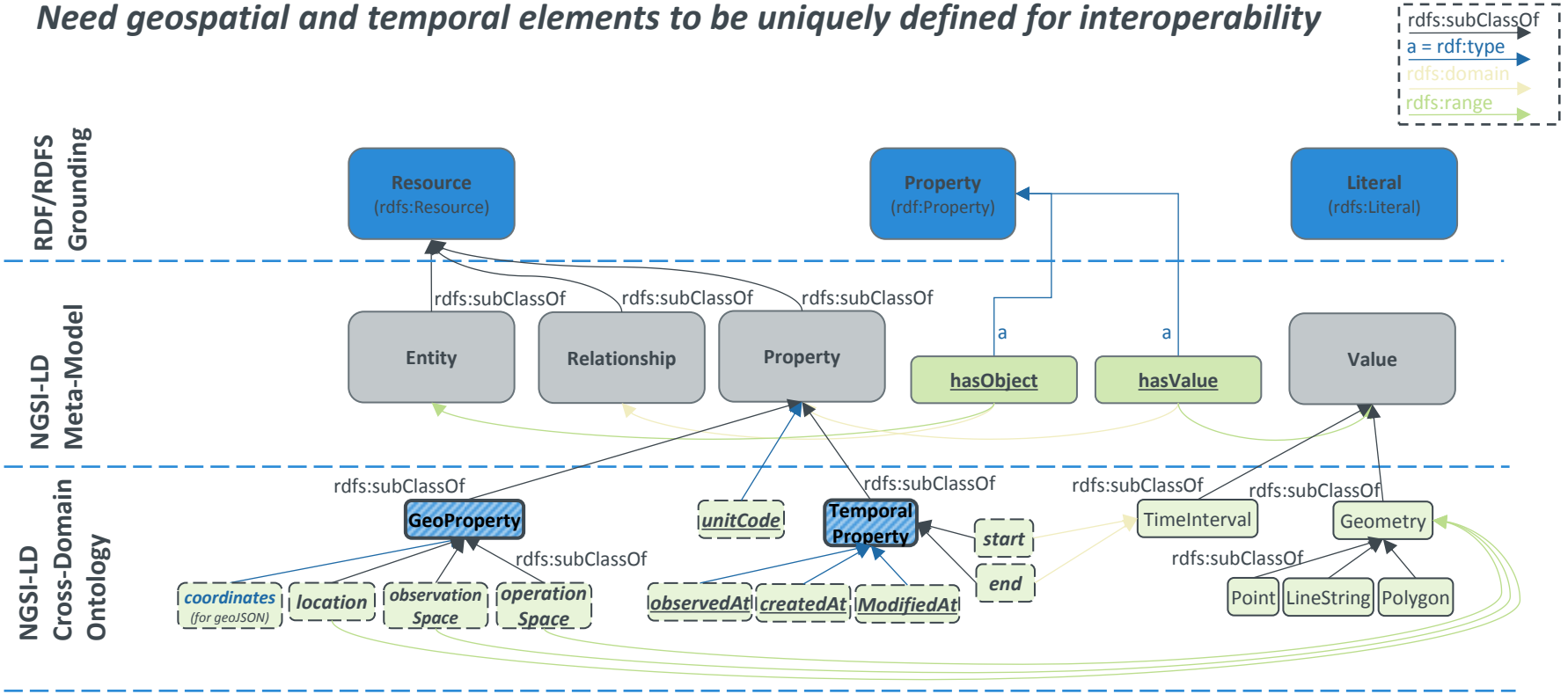
Properties and Relationships can again have properties and relationships

Example: NGSI-LD conceptual property graph



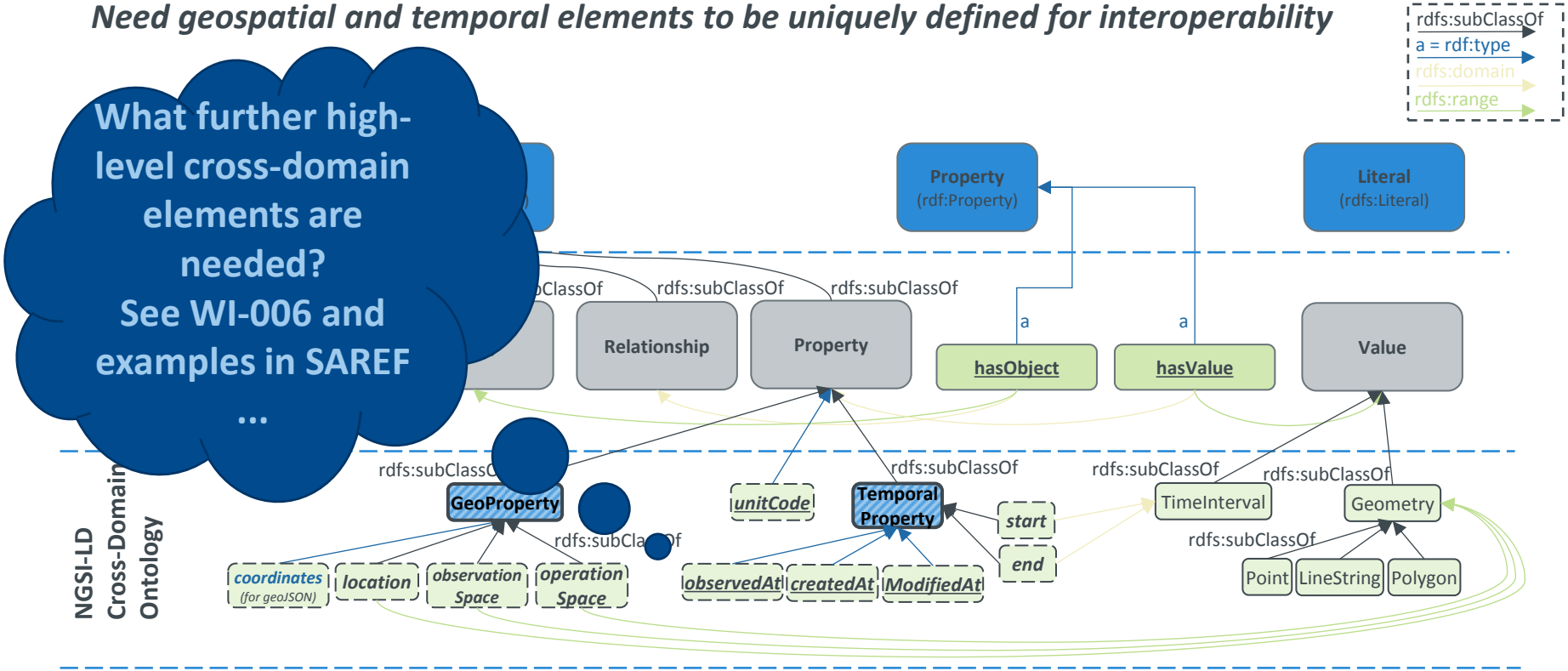
NGSI-LD Information Model – RDF Grounding

Need geospatial and temporal elements to be uniquely defined for interoperability



NGSI-LD Information Model

Need geospatial and temporal elements to be uniquely defined for interoperability

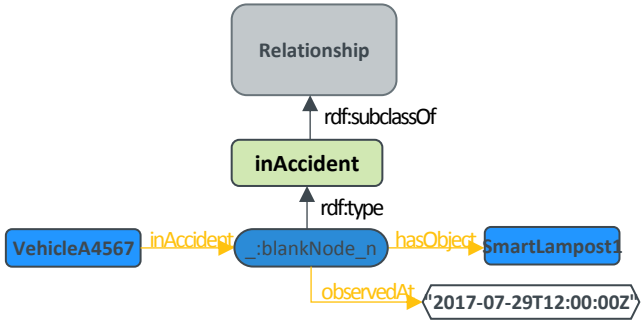


JSON-LD Representation of NGSI-LD – Example

```
{
    "id": "urn:ngsi-ld:Vehicle:A4567",
    "type": "Vehicle",
    "brandName": {
        "type": "Property",
        "value": "Mercedes"
    },
    "inAccident": {
        "type": "Relationship",
        "object": "urn:ngsi-ld:SmartLamppost:Downtown1",
        "observedAt": "2017-07-29T12:00:00Z",
        "providedBy": {
            "type": "Relationship",
            "object": "urn:ngsi-ld:Org:Officer123"
        }
    },
}
```

```
"@context": [
        "http://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context.jsonld",
        "http://example.org/vehicle/my-user-terms-context.jsonld"
]
```

Blank node reification



NGSI-LD Semantic Grounding

Concepts

Person https://forge.etsi.org/gitlab/exampleOntology/Person

Vehicle https://forge.etsi.org/gitlab/exampleOntology/Vehicle

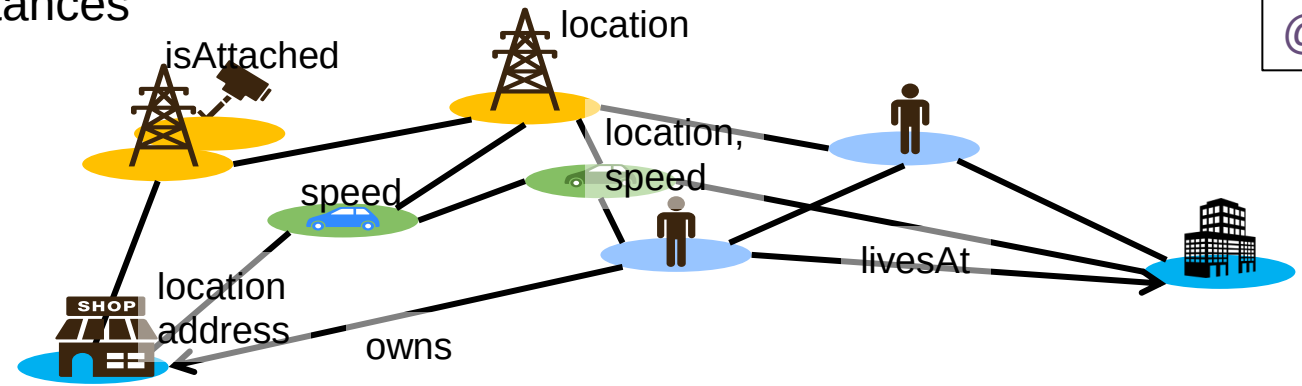
Shop https://forge.etsi.org/gitlab/exampleOntology/Shop

owns https://forge.etsi.org/gitlab/exampleOntology/owns

location https://forge.etsi.org/gitlab/exampleOntology/location

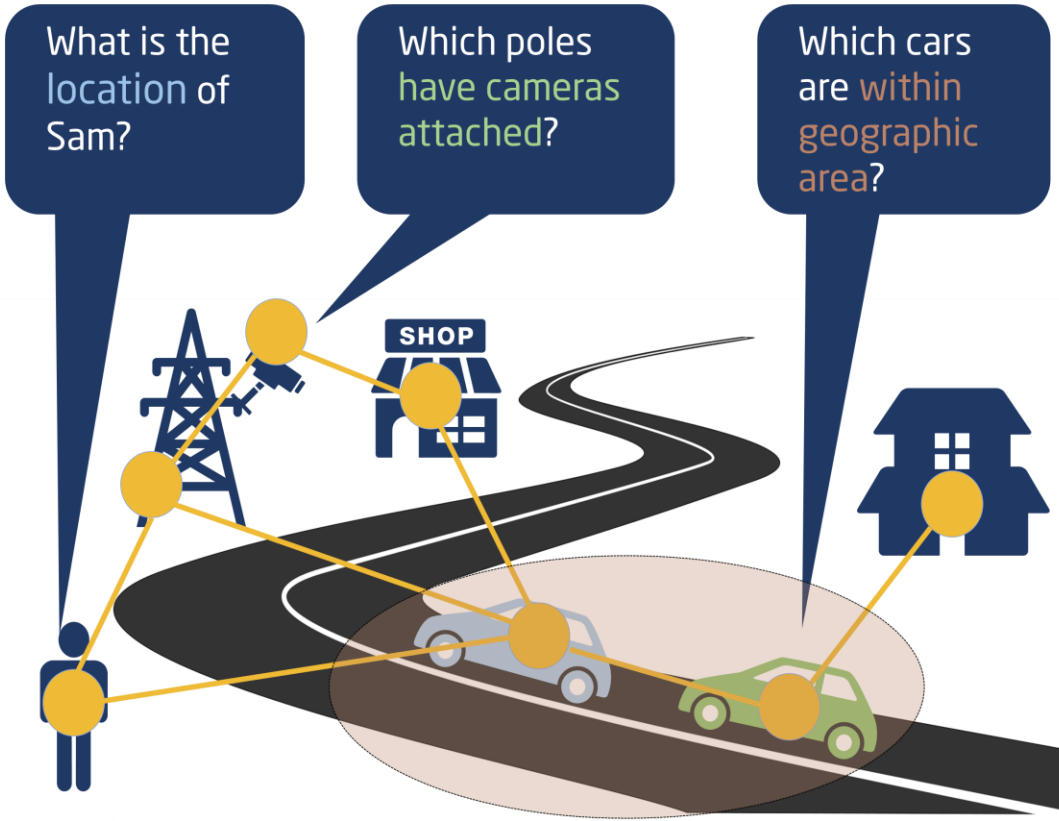
In NGSI-LD Mapping through JSON-LD @Context

Instances



NGSI-LD API

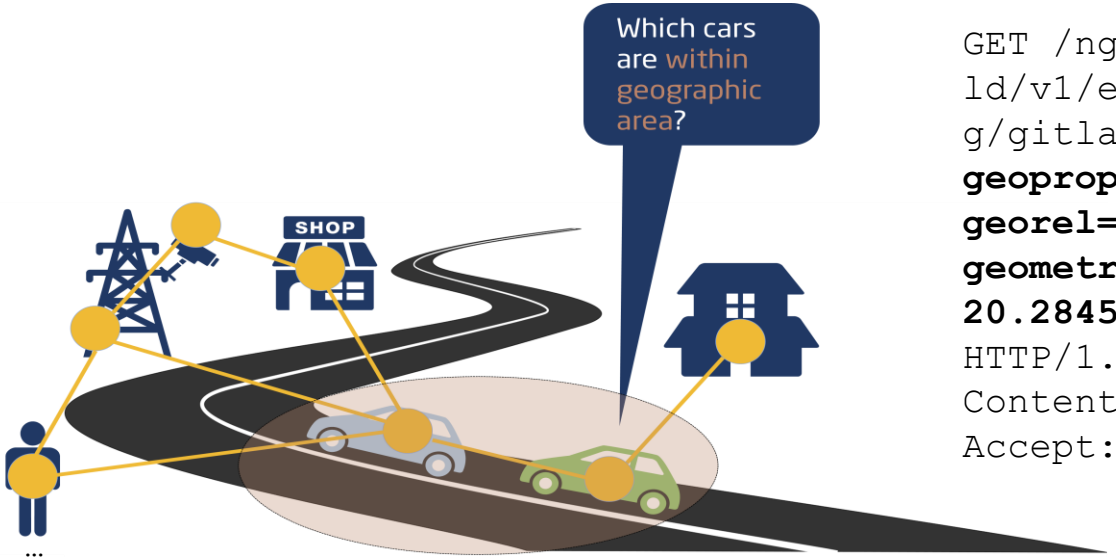
NGSI-LD API Features



NGSI-LD Features

- Knowledge graph: Entities have Properties and Relationships
- Annotated Properties and Relationships
- Synchronous query and asynchronous subscription/ notification interaction
- Filtering & paging
- Geographic scoping
- Temporal queries
- Support for centralized, distributed and federated architectures

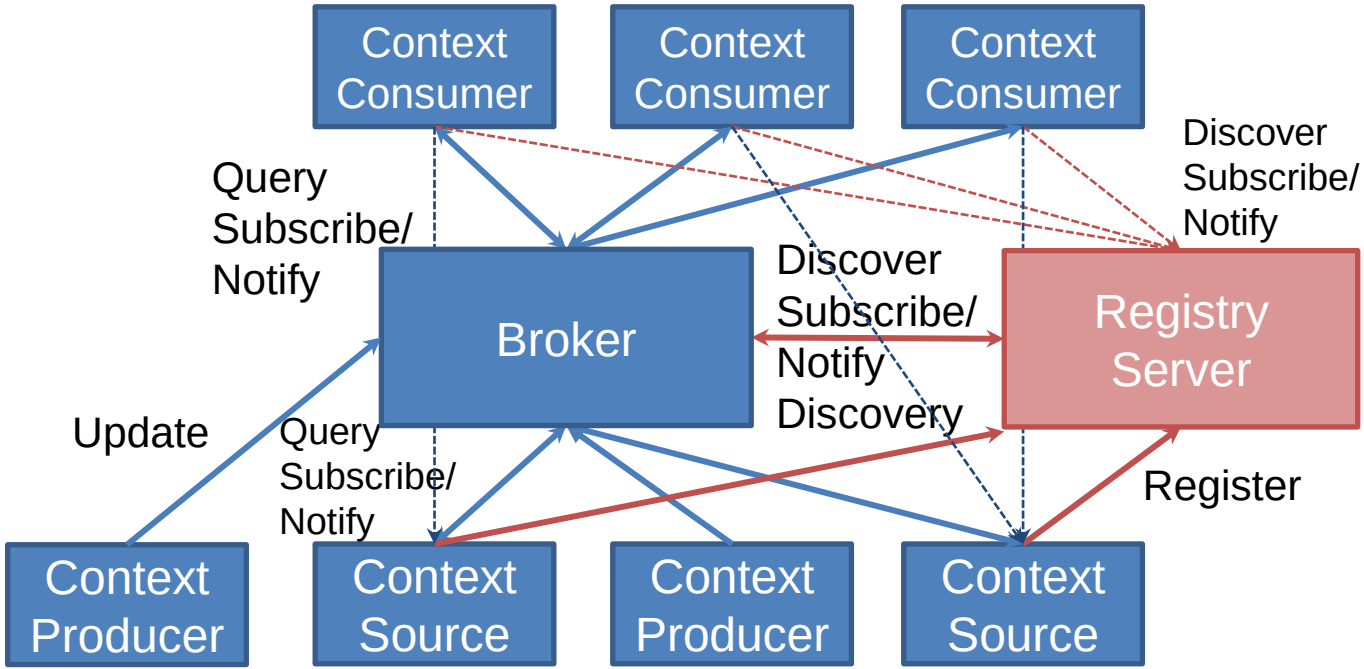
NGSI-LD Example: Geographic Query




```
GET /ngsi-ld/v1/entities?type=https://forge.etsi.org/gitlab/primerContext/StoreOntology/Car&
geoproperty=location&
georel=near;minDistance==1500&
geometry=Point& coordinates=[57.4874120, 20.2845608]
HTTP/1.1Host: cema.nlehd.de:3001
Content-Type: application/ld+json
Accept: application/ld+json
```

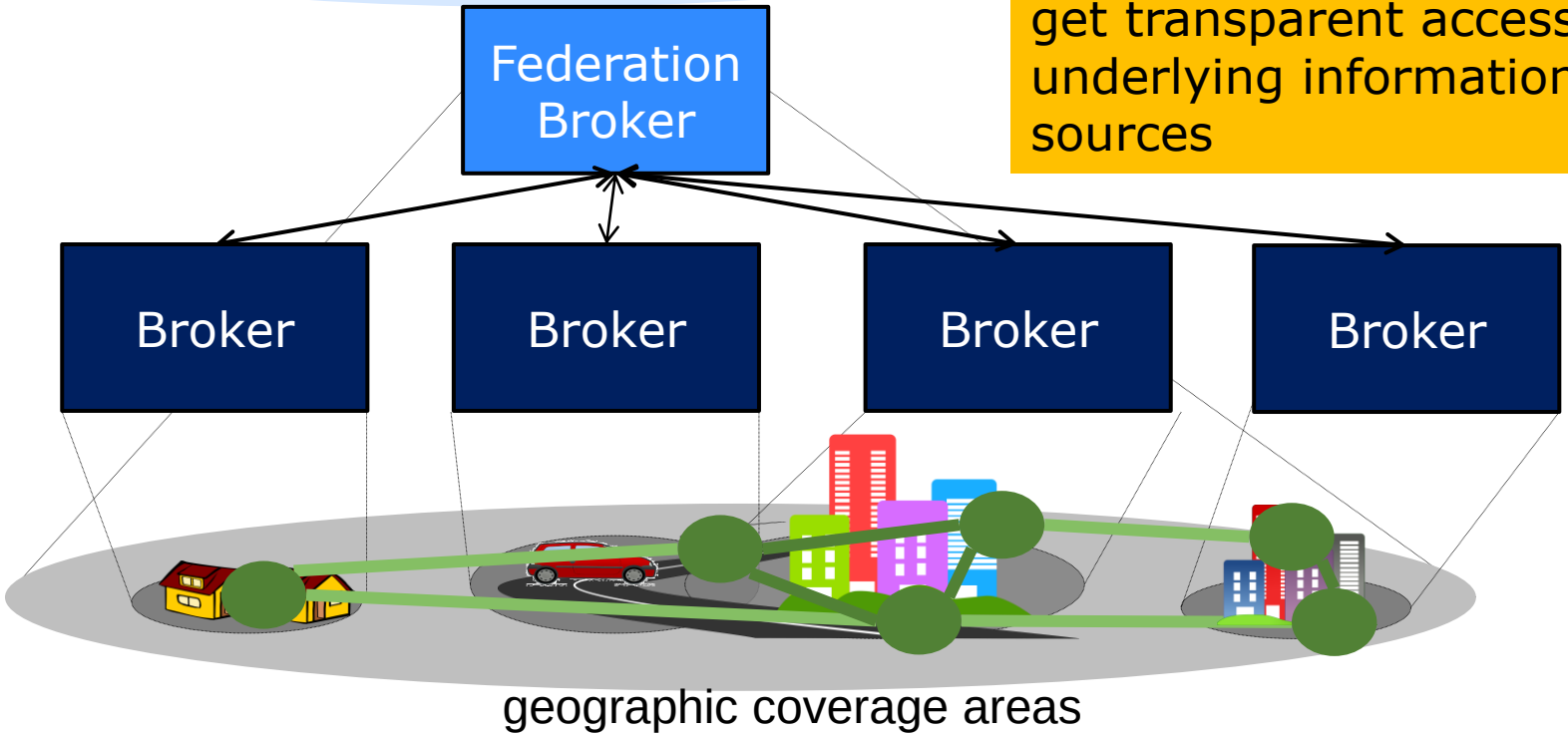
```
…
"id": "urn:ngsi-ld:Car:HD-B1234",
"type": "Car",
"location {          "type": "GeoProperty",
                     "value": {
                              "type": "Point",
                              "coordinates": [57.48765, 20.284567]
                     }
...
"id": "urn:ngsi-ld:Car:HD-B4234"
```

Logical NGSI-LD Architecture



Federation Concept

Federation: Applications get transparent access to underlying information sources



NGSI-LD Data Models

GSMA, OASC & FIWARE

NGSI-LD Data Models

- NGSI-LD requires models defining entity types with their properties and relationships
- Existing NGSI-LD Data Models

IoT Big Data Harmonised Data Model

FIWARE Data Models

- Organizations planning to recommend/adopt data models

The FIWARE Foundation and TM Forum – the global not-for-profit association focused on digital transformation – announced a joint collaboration program to support the adoption of a reference architecture and compatible common data models that underpin a digital market of interoperable and replicable solutions for smart cities.

GSMA IoT Big Data Harmonised Data Model

Recogniser Input	This entity contains a generic model for an input to an AI/ Machine Learning based image/audio recogniser Specification.	Context example.	Entity example.
Recogniser Result	This entity contains a generic model for the resulting outputs from an AI/ Machine Learning based image/audio recogniser where multiple features are processed. Specification.	Context example.	Entity example.
Recogniser Simple Result	This entity contains a generic model for a simple result output from an AI/ Machine Learning based image/audio recogniser Specification.	Context example.	Entity example.
Road	This entity contains a harmonised geographic and contextual description of a Road. Roads are made up of one or more RoadSegment entities. This entity is primarily associated with the Automotive and Smart City vertical segments and related IoT applications. Specification.	Context example.	Entity example.
Road Segment	This entity contains a harmonised geographic and contextual description of a RoadSegment. A collection of RoadSegments are used to describe a Road. This entity is primarily associated with the Automotive and Smart City vertical segments and related IoT applications. Specification.	Context example.	Entity example.
Smart Meter	This entity contains a harmonised description of a Smart Meter, generally applicable for Smart Homes, Industry, Cities and Agriculture. It is designed to be a base for smart meter observations Specification.	Context example.	Entity example.
Smart Meter Observed	This entity contains a harmonised description of a Smart Meter Observation, generally applicable for Smart Homes, Industry, Cities and Agriculture. Specification.	Context example.	Entity example.
Subscriber	This entity contains a harmonised description of a subscriber to a service. This entity is primarily associated with the Smart Home/ Smart Buildings vertical segments and related IoT applications. Specification.	Context example.	Entity example.

Excerpt of Road Example

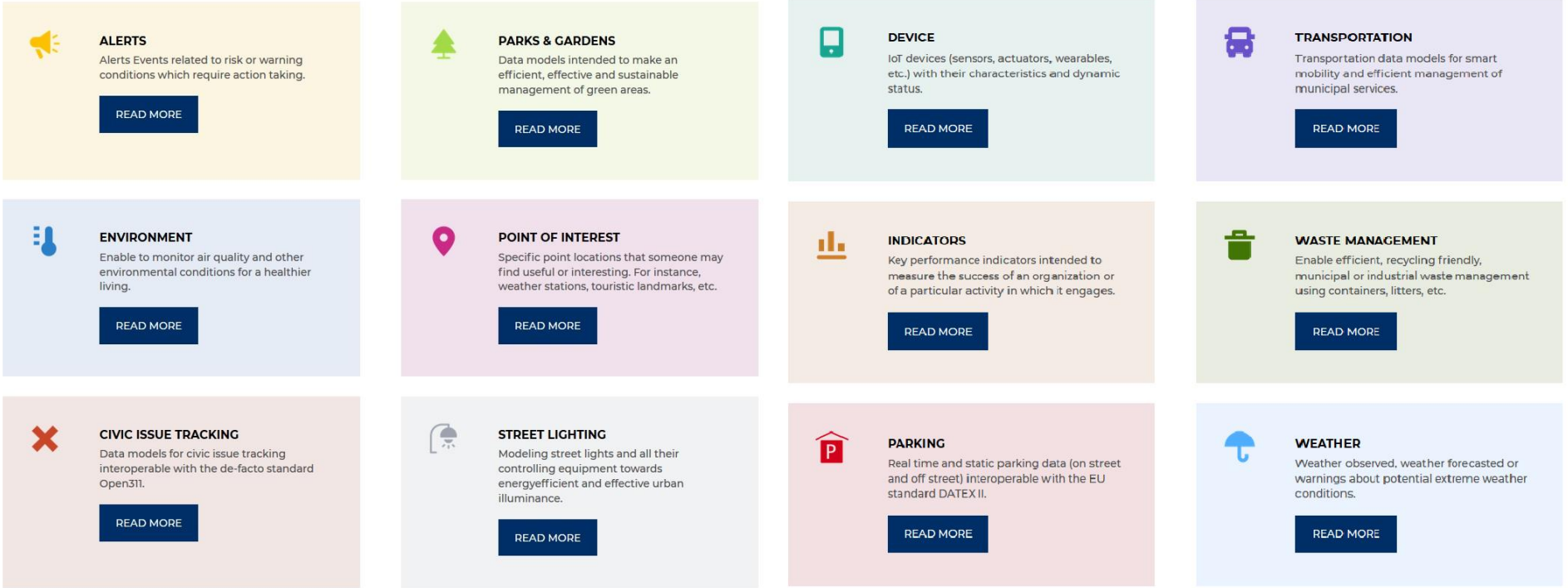

```
"@context": [
    "https://forge.etsi.org/gitlab/NGSI-LD/NGSI-LD/raw/master/coreContext/ngsi-ld-core-context.json",
    "https://raw.githubusercontent.com/GSMADeveloper/NGSI-LD-Entities/master/examples/Road-context.jsonld"
],
"id": "urn:ngsi-ld:Road:19b6f4b7-a9b4-4114-8391-3133bf96aedc",
"type": "Road",
"createdAt": "2017-01-01T01:20:00Z",
"modifiedAt": "2017-05-04T12:30:00Z",
"source": "https://source.example.com",
"dataProvider": "https://provider.example.com",
"entityVersion": 2.0,
"country": {
    "type": "Property",
    "value": "United Kingdom"
},
"roadSegments": {
    "type": "Relationship",
    "object": [
        "urn:ngsi-ld:RoadSegment:2a982120-4d98-425b-a8db-1de5563db6a8",
        "urn:ngsi-ld:RoadSegment:43e255c7-262e-4d6d-95a1-69a53e37dcc0"
    ]
},
"roadClass": {
    "type": "Property",
    "value": "Motorway"
},
```


IoT Big Data Harmonised Data Model Version 6.0, 29 October 2018

https://www.gsma.com/iot/wp-content/uploads/2018/11/CLP.26-v6.0.pdf

https://github.com/GSMADeveloper/NGSI-LD-Entities

FIWARE Data Models



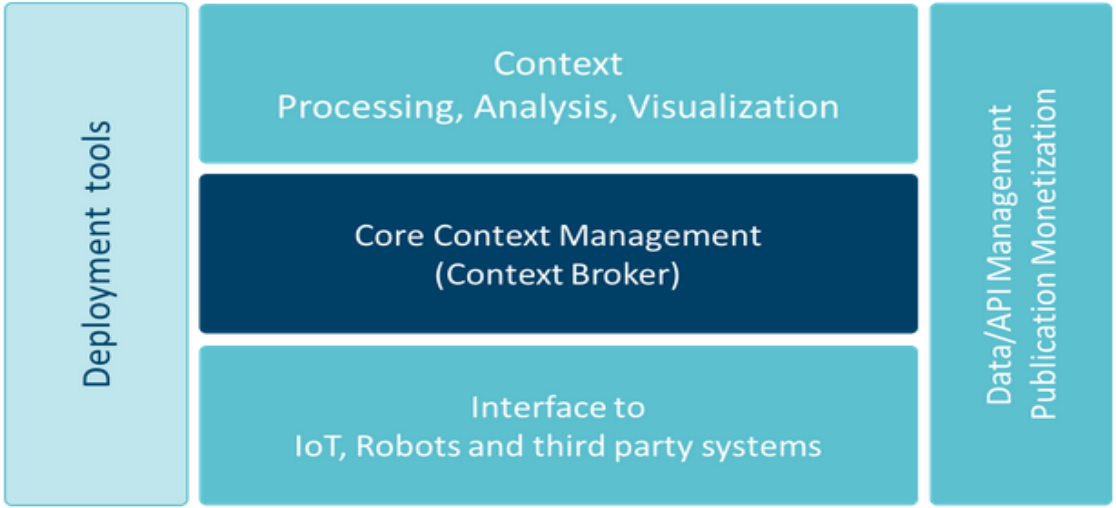
https://www.fiware.org/developers/data-models/, partially based on schema.org

NGSI-LD Usage

FIWARE Generic Enablers

FIWARE

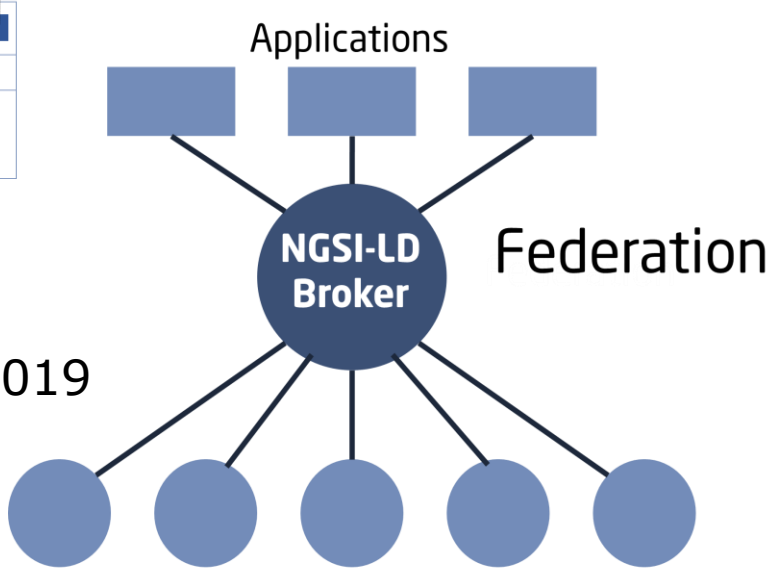
- FIWARE: Core platform of Future Internet PPP, 2012-2016
- Today: Framework of Open Source Platform Components, managed by FIWARE Foundation
- Core component: **FIWARE Context Broker** implementing **NGSI**, currently NGSIv2 -> evolution towards **NGSI-LD** in 2019
- **Plus:** Rich suite of complementary FIWARE Generic Enablers



Source: FIWARE

NEC's NGSI-LD Broker

- Supports NGSI-LD API
- Efficient geographic queries
- *Temporal queries (later 2019)*
- More deployment options and better scalability
  - Indexing
  - Distribution
  - Federation
- Modular & micro-service based
- Experimental version available from April 2019
- Complete version later in 2019 *(current plan)*



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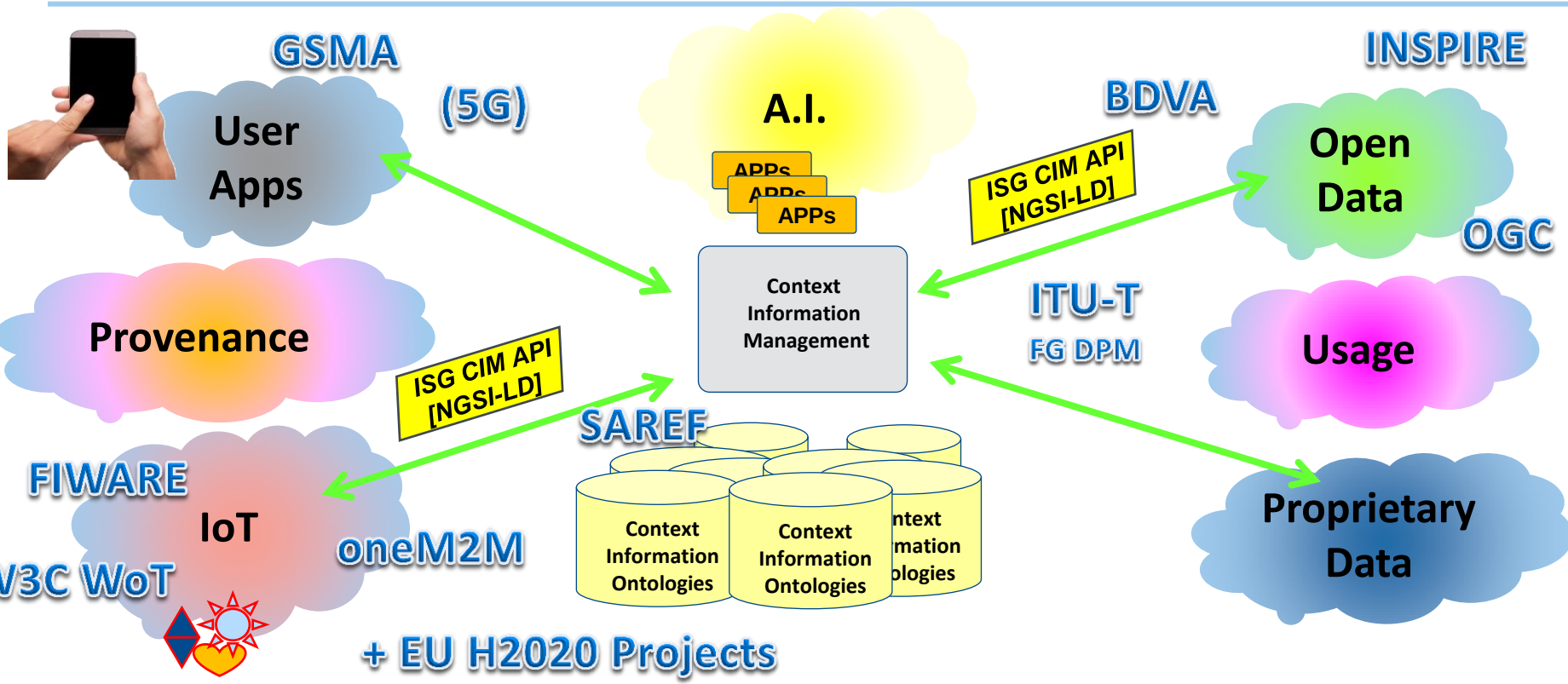
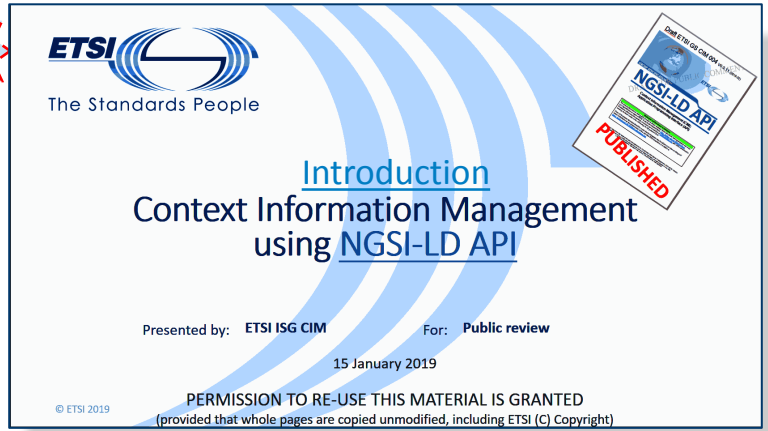
ETSI ISG CIM – Collaborations and further Information

ETSI ISG CIM collaborations for Context Information Management



NGSI-LD API: Introduction, Whitepaper, Use Cases, Spec

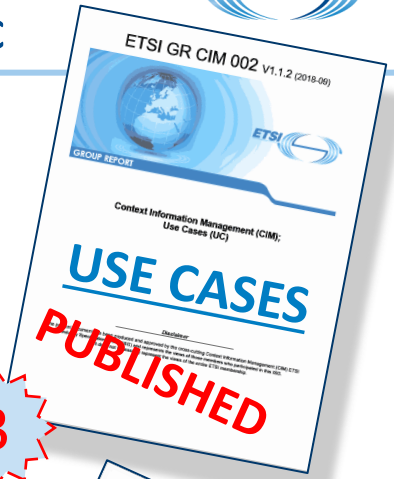
1



Introduction in 9 Sections

- ETSI ISG CIM Mission: link up all data sources
- How info-exchange can help cities
- How can all THAT Information be handled ?
- Example: The happy policeman
- Information Model and Query Language
- Architectures
- Problem: A babel of Ontologies
- Not alone !
- NGSI-LD CURRENT STATUS

3



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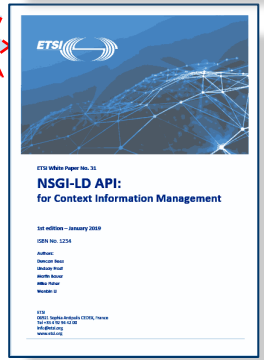
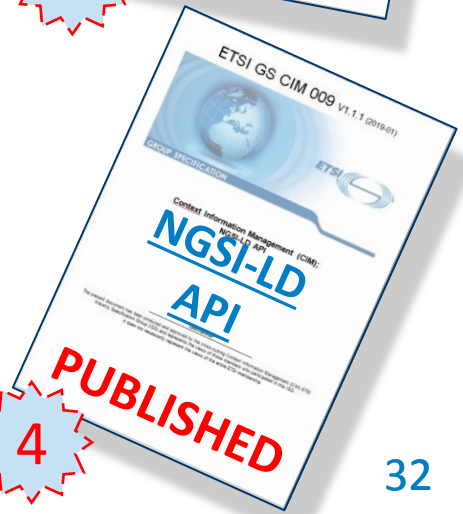


Whitepaper explains concepts

This whitepaper explains the main concepts behind a new data exchange protocol called NGSI-LD which aims to make it easier to find and exchange information with open databases, mobile Apps and IoT platforms. It fills the gap between brief press releases and detailed specification documents for NGSI-LD API and related use cases .

4



Thank You !

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Vice-chairman:
Christophe Colinet (EG4U)

Open pages for consensus material:
https://docbox.etsi.org/ISG/CIM/Open
+ visit at: https://portal.etsi.org/CIM


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