EU-JAPAN DIGITAL WEEK 2025

31 MARCH - 7 APRIL, 2025

TOKYO, JAPAN

THE EU-JAPAN DIGITAL WEEK IS ORGANISED AS PART OF THE EU-JAPAN DIGITAL PARTNERSHIP

Introducing the role of NGSI-LD in enabling flexible and interoperable data exchanges across domains including handling of provenance information

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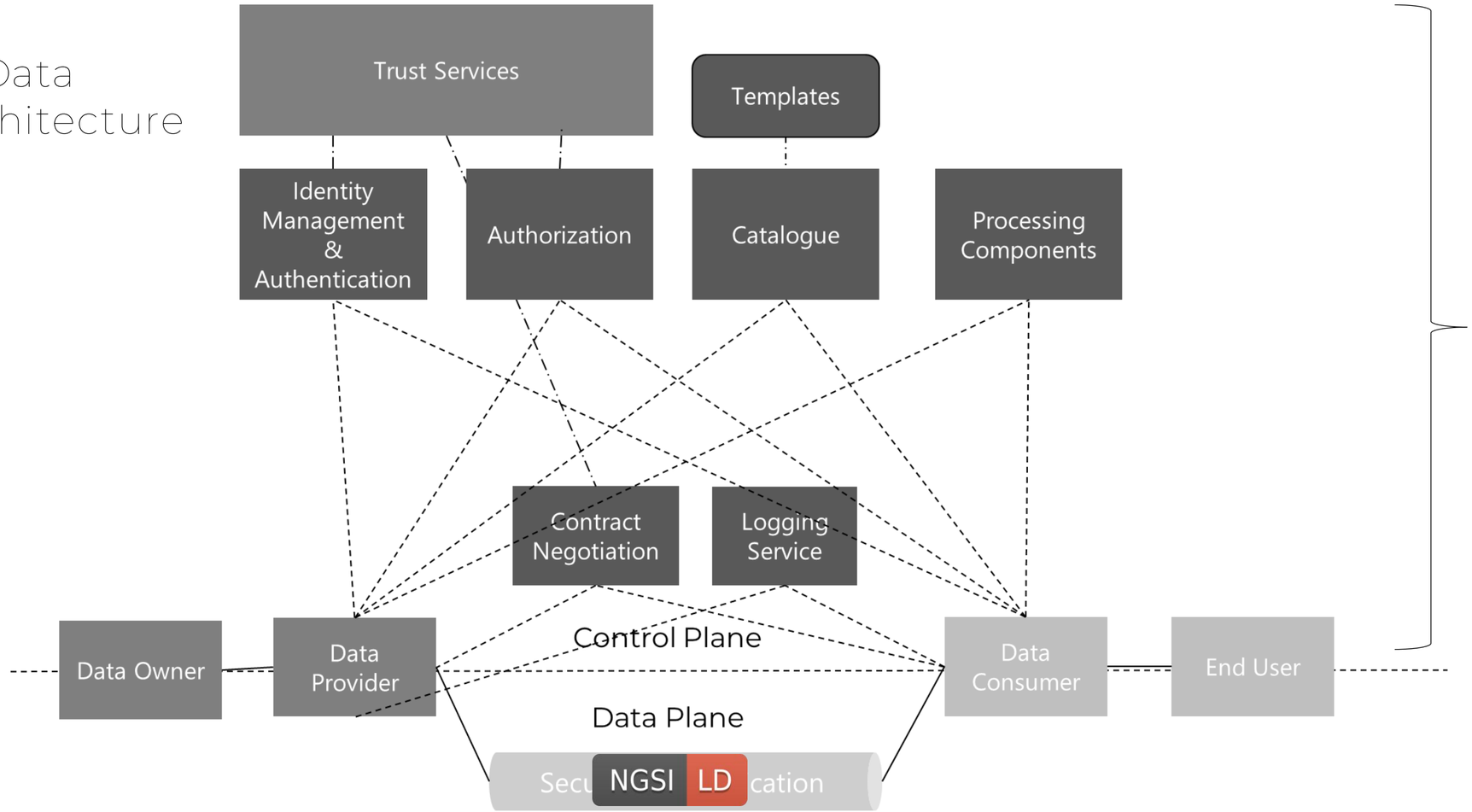
Interoperable Trusted Data Exchange

Abstract Data Space Architecture



Framework that enables Trusted Data Exchange
→ Requires standardization

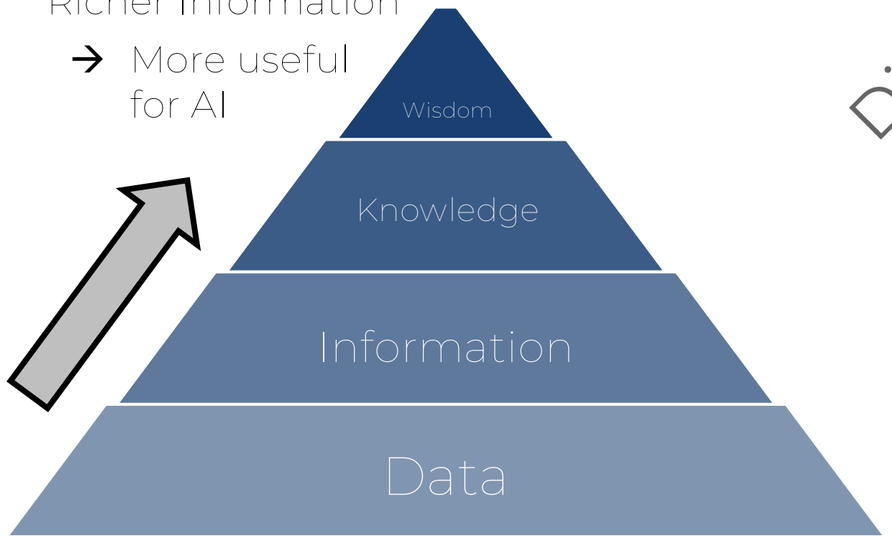
Trusted Data Exchange (out-of-scope of many activities), but: also requires standards

What is NGSI-LD?

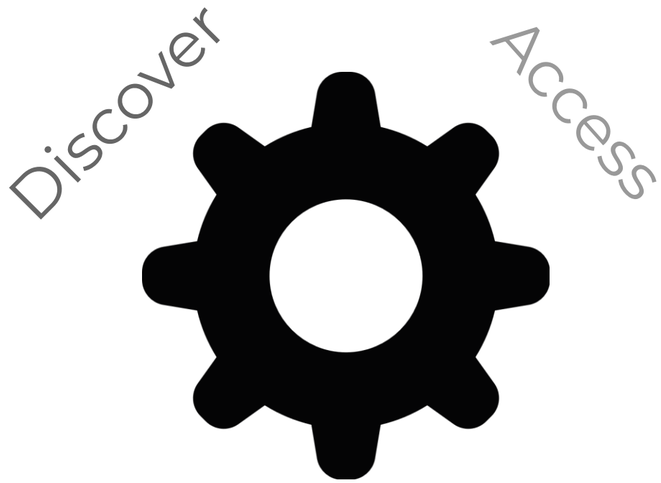
Next Generation

Higher Abstraction,
Richer Information

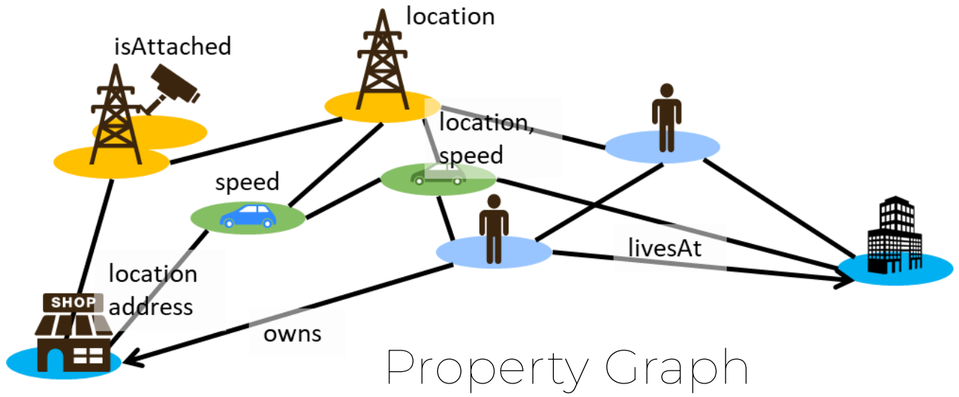
→ More useful for AI



Service Interface

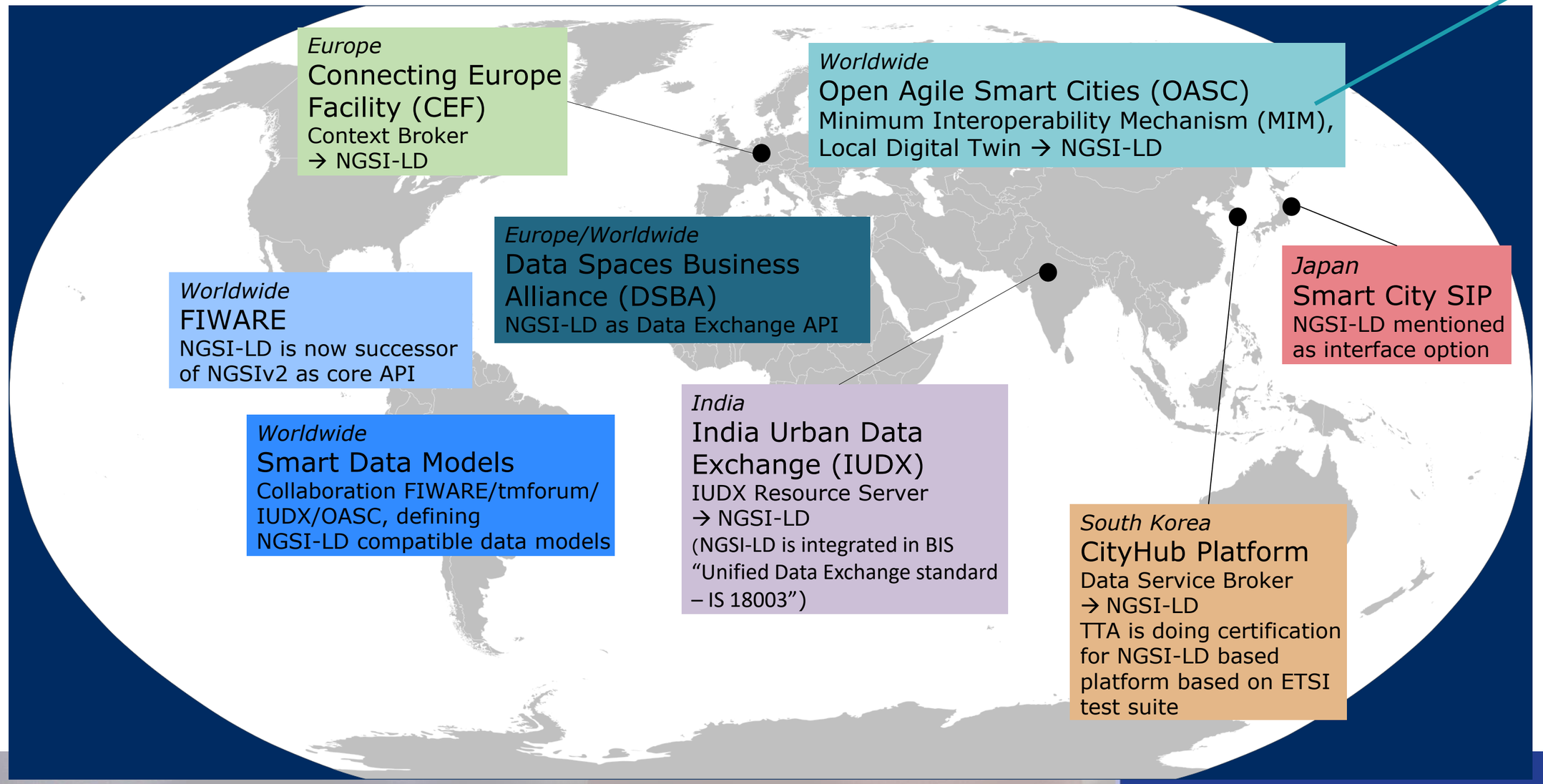


Linked Data



Property Graph

World-wide Adoption of NGSI-LD



NGSI-LD – Evolution and specification in 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

- Evolution of NGSI Context Interfaces in ETSI →NGSI-LD
  - Currently in the Industry Specification Groups (ISG) for cross-cutting Context Information Management (ETSI ISG CIM)
  - Activity will move to TC Data

https://www.etsi.org/deliver/etsi_gs/CIM/001_099/009/01.08.01_60/gs_CIM009v010801p.pdf

2010 OMA NGSI
Context API in Open Mobile Alliance (OMA)

→

2012-2016: NGSI v1/v2
FIWARE project develops binding and evolves OMA NGSI standard

→

2019: NGSI-LD
Evolution as ETSI ISG CIM specification based on JSON-LD

High-Level Design Goals of NGSI-LD

- *Evolution of OMA/FIWARE NGSI Context Interfaces*
- Enable applications to specify WHAT information they require (based on the NGSI-LD Information (Meta) Model) – with *projection* and *selection*, including *geographic scoping*, graph query functionality, and temporal interface
- Put NGSI-LD Information Model on a solid conceptual grounding
  - Property graph model
  - Enable semantic concept definitions
  - Enable linking to existing information

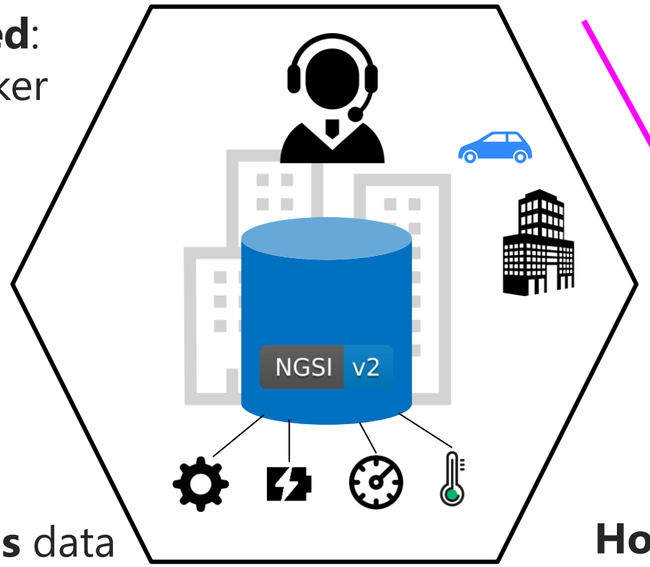
  } Linked Data
- Support central as well as distributed and federated NGSI-LD system architectures with arbitrary information distribution

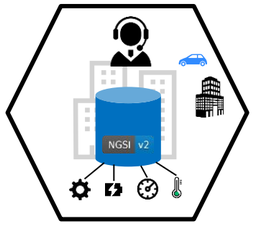
High-level Comparison Deployment Options – NGSIv2 to NGSI-LD

NGSI v2

Single operator
→ ensures homogeneity

Centralized:
single broker





Centralized:
disconnected to other deployments

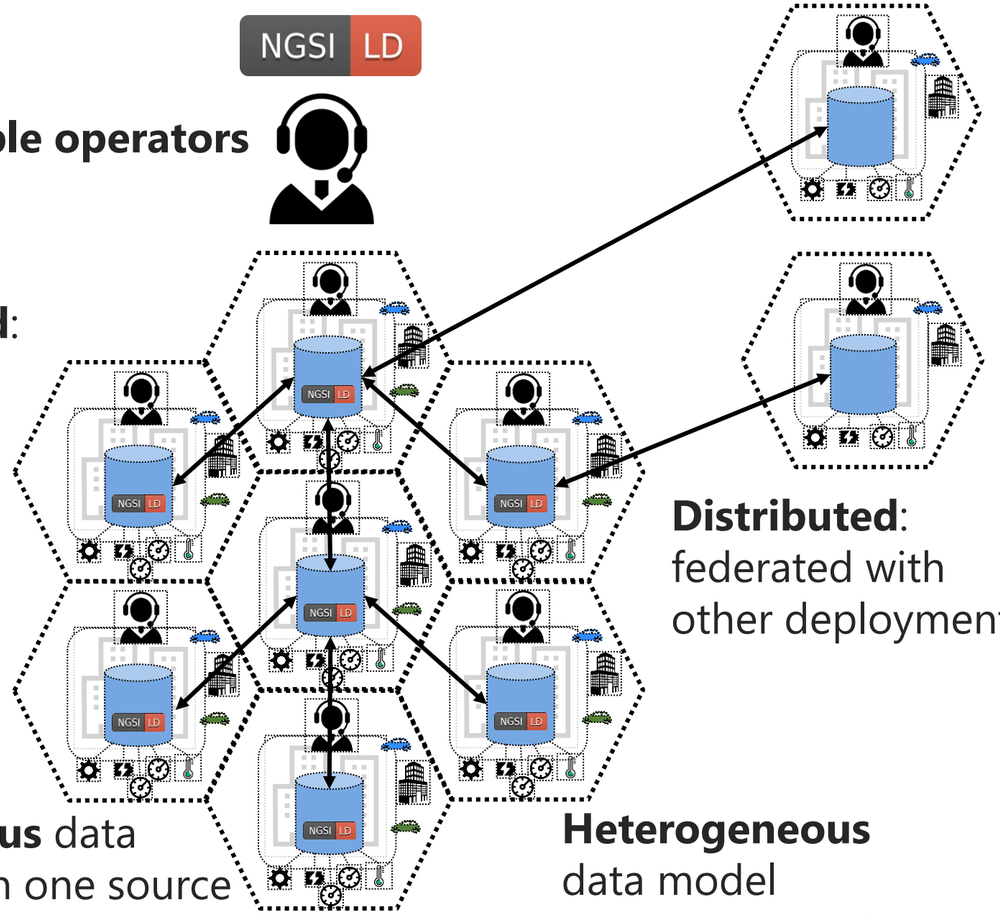
Homogeneous data
→ one source for each information (e.g. speed of car)

Homogeneous data model (schema)
→ short names sufficient

NGSI LD

Multiple operators

Distributed:
multiple brokers

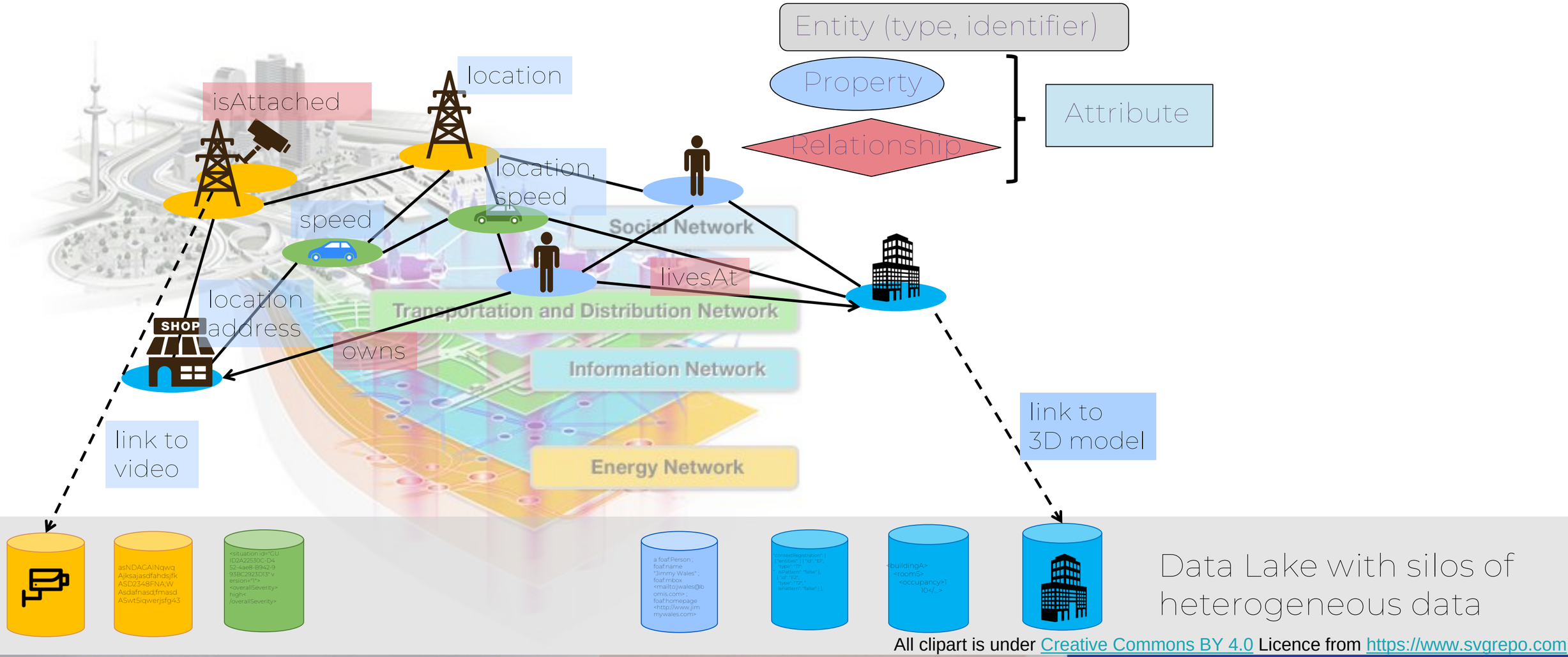


Distributed:
federated with other deployments

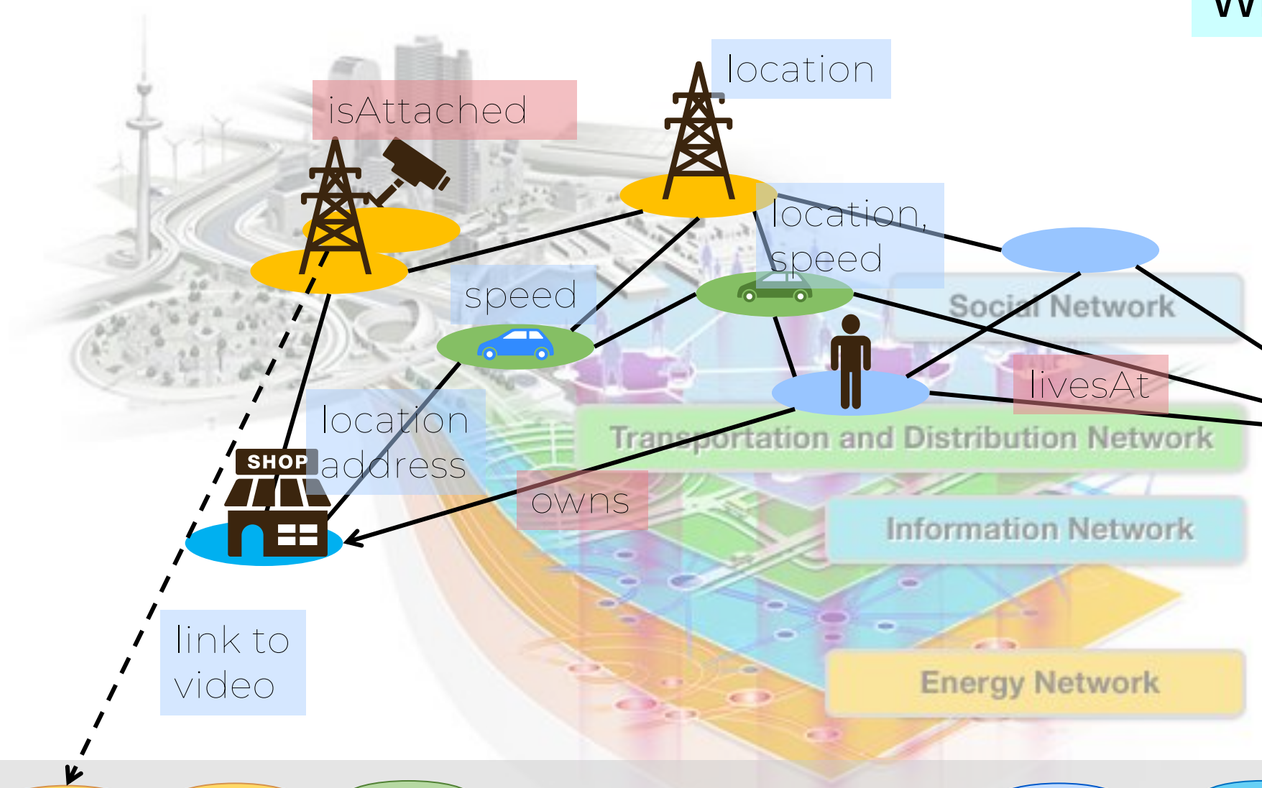
Heterogenous data
→ more than one source for each information (e.g. speed of car from Speedometer and GPS)

Heterogeneous data model (schema) possible
→ short names mapped to long URIs

NGSI-LD Information Model (Property Graph)



NGSI-LD-compatible Data Model



What entity types are there?

What properties can instances of a certain entity type have?

What relationships can instances of a certain entity type have?

→ Data Models

link to 3D model

Examples: https://smartdatamodels.org/

Data Lake with silos of heterogeneous data

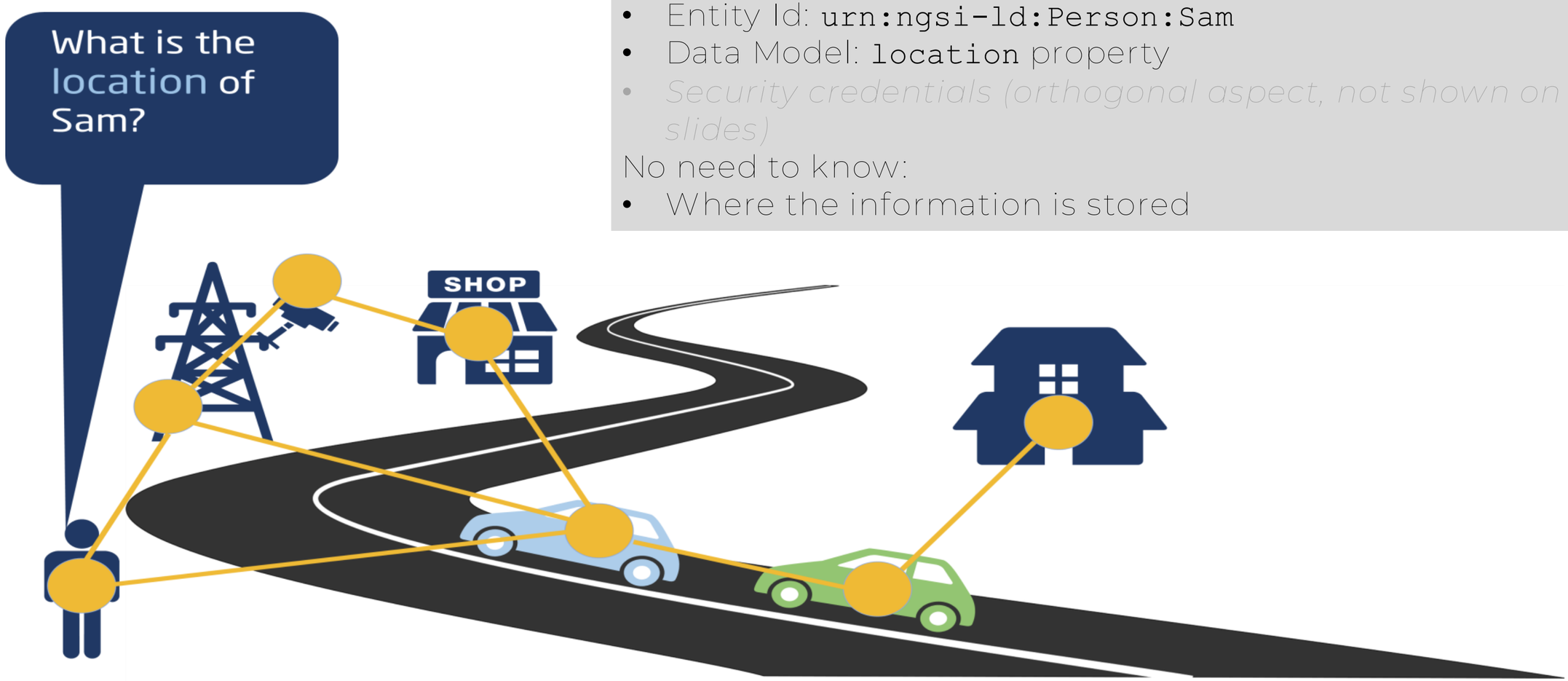
NGSI-LD API – Example: Retrieve Specific Entity

What do applications need to know:

- Base URL: `http://localhost:9090/ngsi-ld/v1/entities/`
- Entity Id: `urn:ngsi-ld:Person:Sam`
- Data Model: `location` property
- *Security credentials (orthogonal aspect, not shown on following slides)*

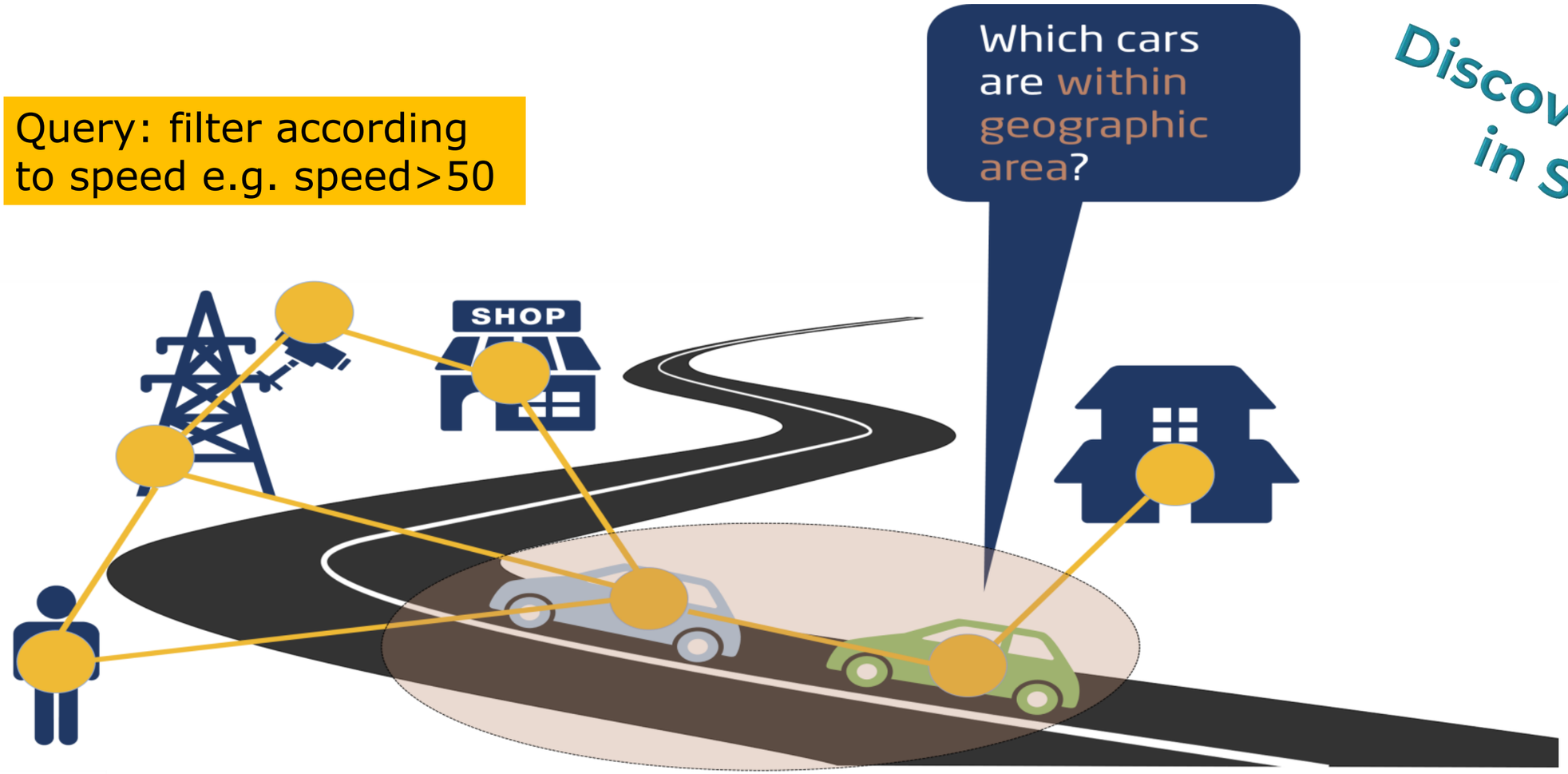
No need to know:

- Where the information is stored



NGSI-LD API – Example: Geographic Query

Query: filter according to speed e.g. speed>50

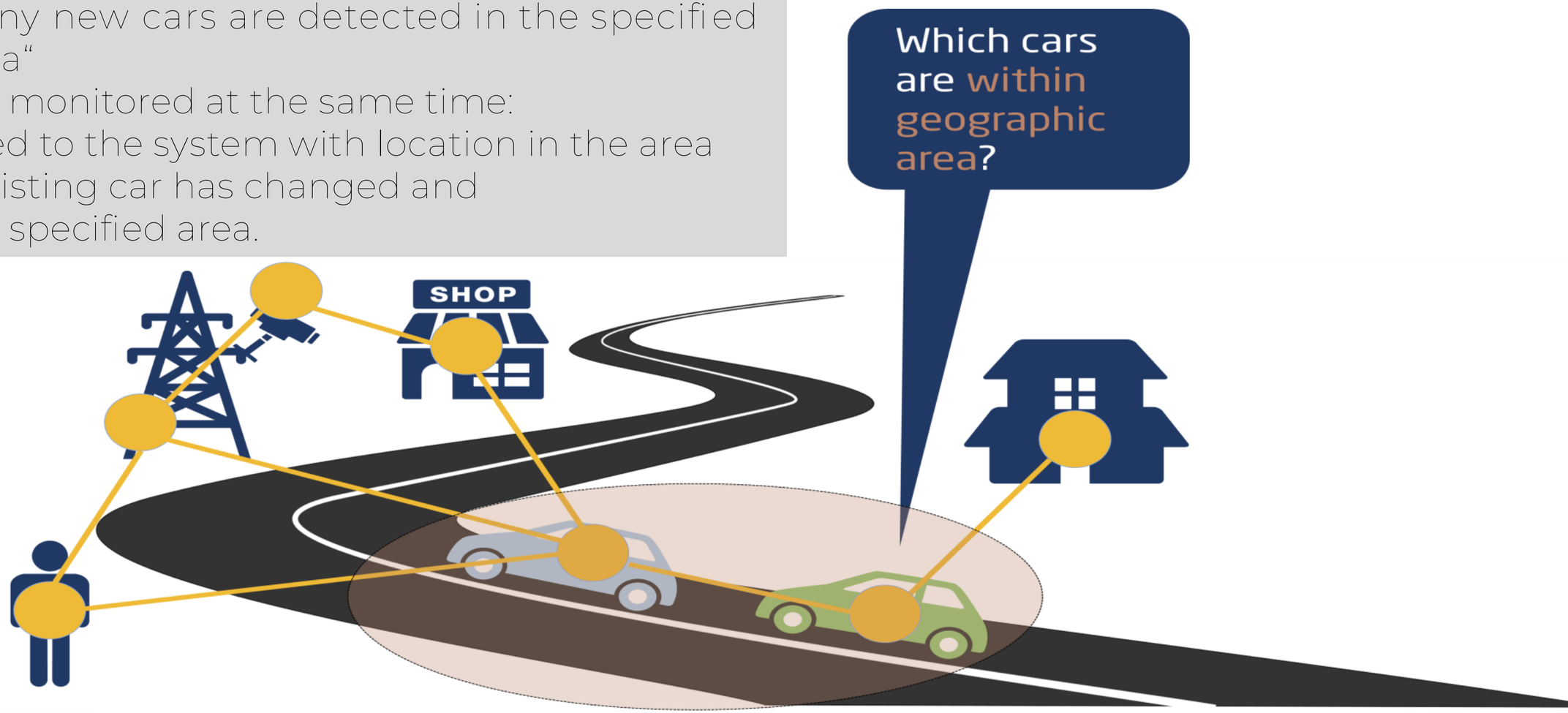


Discovery & Retrieval in Single Step

NGSI-LD API – Example: Subscription / Notification

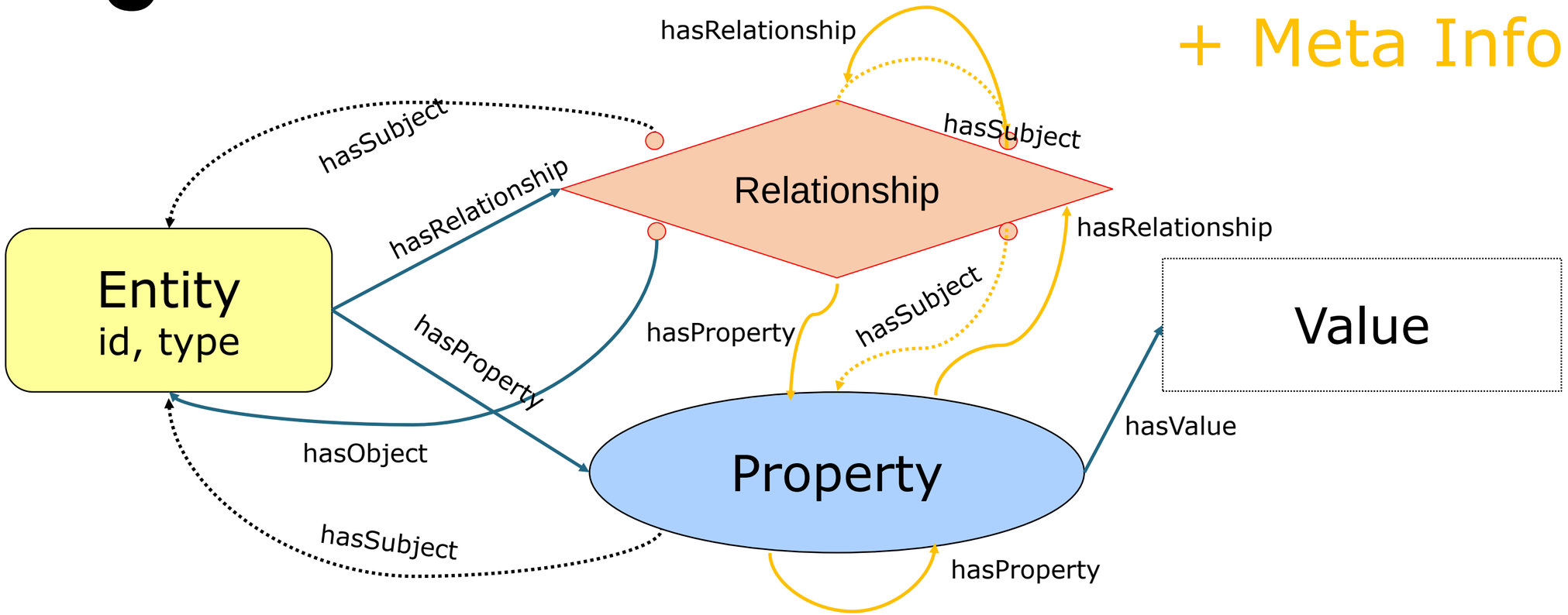
“ Notify me, if any new cars are detected in the specified geographic area“
Two cases to be monitored at the same time:

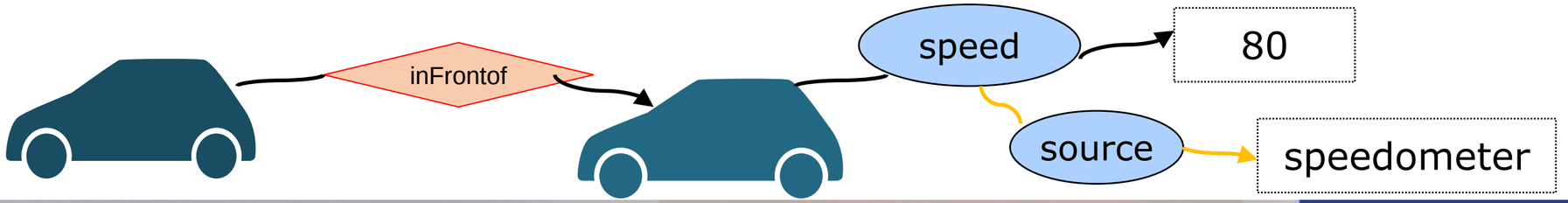
- new car added to the system with location in the area
- location of existing car has changed and
  is now within specified area.



Logical NGSI-LD Information Model

+ Meta Information





Provenance

1. Data Origin

- Source: Identifying the original source of the data, including the creator, time, and system responsible for its generation.
- Location: Where the data was initially created or gathered.
- Context: Understanding the circumstances surrounding the data's creation, such as the purpose or methodology used.

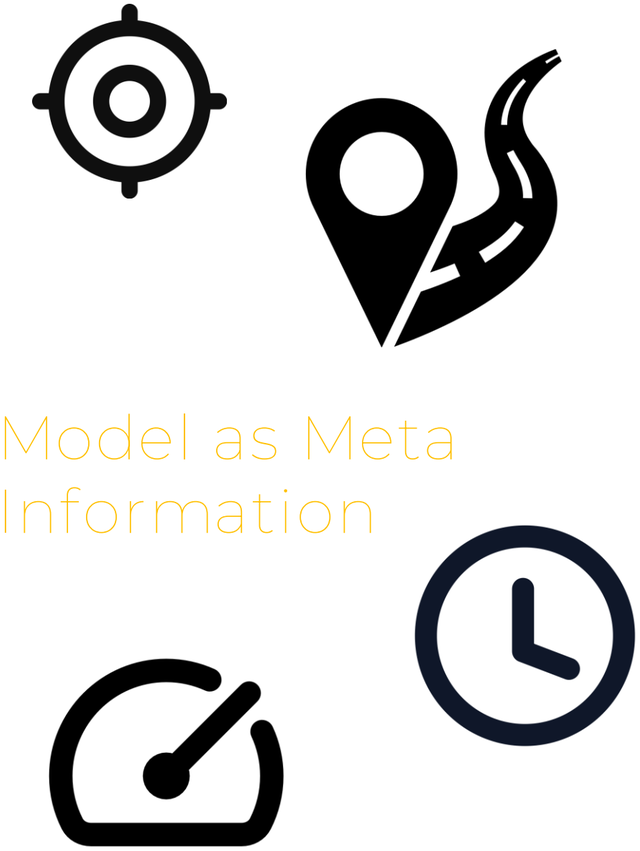
2. Data Processing History

3. Data Ownership

4. Data Quality and Validation

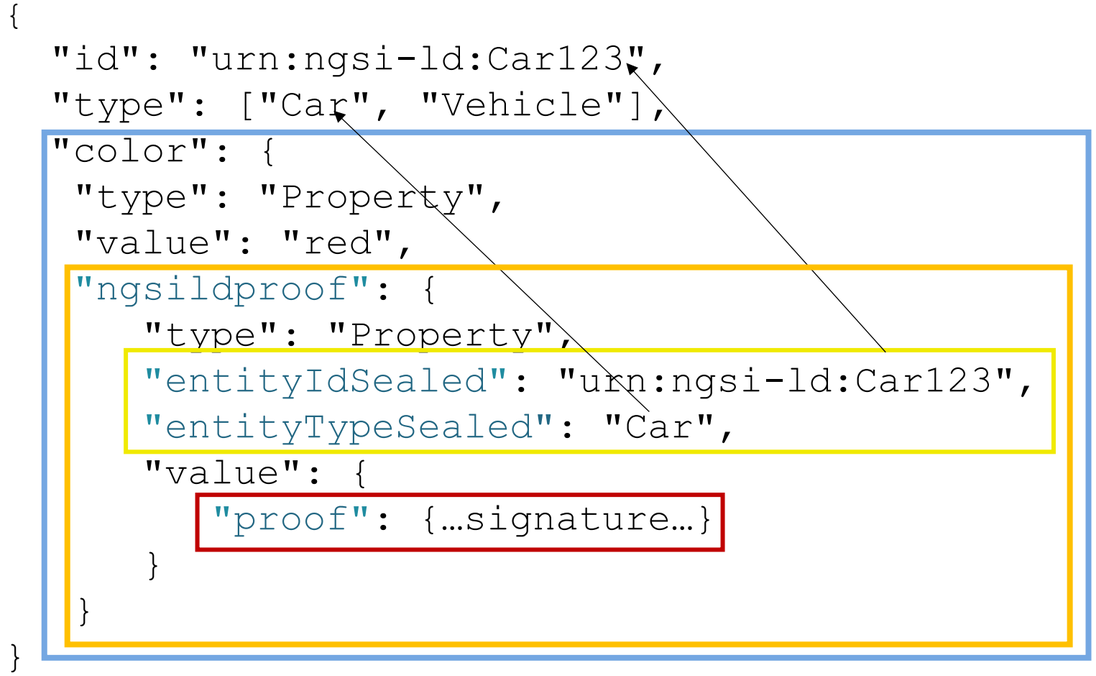
- Accuracy: Assessing the accuracy and reliability of the data and its sources.
- Completeness: Determining if the data is complete and contains all necessary information.
- Timeliness: Evaluating the timeliness of the data and its relevance to the current context.
- Data Validation: Implementing mechanisms to ensure the data's integrity and validity throughout its lifecycle.

Model as Meta Information



Provenance and Integrity

- Source of information + ensuring integrity end-to-end, i.e. no tampering is possible
- Attribute (Property or Relationship) is atomic element in NGSI-LD → add signature to Attribute (signed with private key of source)
- Concept of “atomic entity”, i.e. original entity id, type together with signed attribute instance.
- Signature is based on atomic entity, which can be reconstructed and compared



Summary

- NGSI-LD can be used for flexible Data Exchange in Data Spaces
- NGSI-LD enables applications to specify WHAT information they require (based on the NGSI-LD Information (Meta) Model)
- NGSI-LD targets Cross-Domain Reuse of Data based on agreed Information Models (semantic concepts)
- NGSI-LD supports the representation of provenance information as meta information and guarantees integrity through attribute signatures

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