ETSI ISG CIM Specifications

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ETSI ISG CIM specifications to manage context information and interoperability across vertical domains

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ETSI ISG CIM Deliverables (with links)


✔ MI/CIM-001-AB (MI) Annotated Bibliography (ETSI members only)
✔ GR/CIM-002-UC Use Cases ➔ published v1.1.1 HERE
✔ GS/CIM-006-MOD0 Information Model(s) ➔ published v1.1.1 HERE
✔ GR/CIM-007-SEC Security and Privacy
✔ GR/CIM-008-NGSI-LD-Primer for Developers published v1.1.1 HERE
✔ GS/CIM-009-NGSI-LD-API ➔ published v1.2.2 HERE and new version soon

✔ Whitepaper explains main concepts of NGSI-LD
✔ Open Area for further materials
ETSI ISG CIM: Mission

Make it easier

for END-USERS

and CITY DATABASES

and IoT internet-of-things

and third-party APPS

to exchange KNOWLEDGE
Important issues in sharing data
Important issues in sharing data

Context Information Management

- Simple coding!
- High data rate
- Definition re-use
- Restricted access
- Source Info and licenses
- IoT

A.I.

- Applications
- Highly diverse databases

Open Data

Proprietary Data

User Apps

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MISSION TASKS

#1: Use Open Data 5 Star Model
#2: Make the Components “Smart”
#3: Keep it simple
#4: Adapt to Local, Central or Federated Sources
#5: Be flexible to model real world
#6: Build on past experience and user expertise (timeline)
#1: use Open Data 5 Star Model (W3C, Berners-Lee)

Open Data

The World Wide Web Consortium (W3C) has developed a five star model to describe different characteristics of open data, and its usefulness for people wishing to reuse it. It is being used globally as a model for assessing data readiness for re-use.

The 3-star level is considered the minimum standard for release of government’s public data of single agencies for re-use.

The 4/5-star level is considered required for multi-agency / multi-city scenarios.

* Data is visible, licensed for reuse (CC), but requires considerable effort to reuse.

** Data is visible, licensed, and easy to reuse, but not necessarily by all.

*** Data is visible and easy to reuse by all (not restricted to using specific software).

**** Data is visible, easy to use and described (with meta data) in a standard fashion.

***** Data is visible, easy to use, described in a standard fashion and meaning is clarified by being linked to a common definition (i.e. Ontology).

Adapted from: www.slideshare.net/FIWARE/fiware-global-summit-ngsild-ngsi-with-linked-data
#6: Build on past experience and user expertise (timeline)

## Specifications

### Open Source Software

- **2009-2010: OMA NGSI**
  - Defined abstract Context API (no protocol binding)

- **2012: NGSI v1**
  - FI-WARE EU Project develops HTTP/XML binding based on OMA NGSI

- **2015-2016: NGSI v2**
  - FIWARE develops new version with JSON binding

- **2017-2020: NGSI LD**
  - Evolution in ETSI ISG CIM specification using JSON-LD, which has migration path for NGSIv2

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**Property Graphs explosion in ICT**
ARCHITECTURES
Information-centric with developer-friendly NGSI-LD

Context Information Management Layer

Machine Reasoning Systems

A.I.

NGSI-LD Advantages
- information-centric
- JSON-LD syntax
- joining verticals

User Apps

IoT

Open Data
Information-centric with developer-friendly NGSI-LD
Various Architectures possible

Centralised

- Simplicity

Distributed

Federated

NGSI-LD API
Various Architectures possible

Centralised  Distributed  Federated

More flexibility

NGSI-LD API
Various Architectures possible

NOTE: functionality of Context Broker or Context Registry is described in a separate presentation. Their roles are to allow discovery and authorised access to repositories of Context Information, as well as scaleable execution of Queries.

Centralised

Distributed

Federated

Integration of multiple Systems
NGSI-LD INFORMATION MODEL
Example Data Model: Smart Lampposts in a city

The townhall database has locations and functions of its smart lampposts

The townhall database

URN:ngsi-ld: SmartLamppostB: Downtown1

location: [49.398, 8.672]

accuracy: 5%

trafficFluidity: 0.9

StreetFurniture

sensor: Cam1

Sensor

transport

NGSI-LD Information Model

Core Meta-Model

Cross-Domain Ontology

Domain-Specific Ontologies

Smart City Ontology

Smart Agri Ontology

Smart Building Ontology

Smart Industry Ontology

Entity

Relationship

Property

Geolocation

Temporal Property

coordinates (for geospatial)

location

observation Space

operation Space

observedAt

createdAt

ModifiedAt

start

end
Example Data Model: Grocery store (from NGSI-LD Primer)

- **Store**
  - Name
  - Postal Address
  - Geographic Location
  - contains (Shelf)

- **Customer**
  - Name
  - Postal Address
  - has Visited (Store)
  - has Purchased (Product, at Store)

- **Shelf**
  - Location
  - Max Capacity
  - is Contained In (Store)
  - holds (Inventory Item)

- **Inventory item**
  - Stock Count
  - Shelf Count
  - relates To (Product)
  - is Held In (Shelf)
  - is Inventory Of (Store)

- **Product**
  - Name
  - Price
  - Size

Figure 4.2: Entity types, relationships and properties of use case

Figure 6.2: Entity types, properties and relationships

Source: https://www.etsi.org/deliver/etsi_gr/CIM/001_099/008/01.01.01_60/gr_CIM008v010101p.pdf
Example Data Model(s) for Water: which is better??

**BUT for which purpose is one way better?**

a) Import of legacy data (even from paper forms!)
b) Easy search for specific types of things (from an existing inventory)?
c) Modelling of data history for maintenance reasons?

Water Networks are examples for MANY network problems (including telecom networks, energy grids, road transportation, waste collection networks, railway networks, logistical networks, etc)

**Graphical Representation:**
- **a. everything is a node/entity**
  - Relationships are just abstract connections
- **b. tanks & branches are nodes**
  - Pipes are instantiated relationships

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PROBLEM: A BABEL OF ONTOLOGIES
Issue: Lack of Domain Consensus

Need consensus in each domain
e.g. Here we see 4 in Buildings
e.g. Here we see dozens in IoT ??

EC has begun regulating to reduce these barriers to trade / efficiency!
e.g. **INSPIRE Directive** (deadline 2019)

„To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the INSPIRE Directive requires that common implementing Rules (IR) are adopted...“

**Metadata, Data Specifications, Network Services, Data and Service Sharing, Spatial Data Services, Monitoring and Reporting**
SAREF: Smart Applications Reference Ontology (ongoing work within ETSI SmartM2M)

Methods:
✔ Analysis of nn semantic assets in the domain
✔ Selection of a short list (nn assets) to use for the reference ontology
✔ Translation of each of the nn semantic assets into OWL ontology
http://saref.etsi.org/core/
✔ Mapping between semantic assets using SAREF

small extract as example
The SAREF4CITY specification, ETSI TS 103 410-4, has been developed with the stakeholders who would need ontology such as other standardization bodies, associations, IoT platforms and European projects (including SynchroniCity, ESPRESSO and the Smart City Lighthouse projects) and initiatives. Use cases include eHealth and smart parking, air quality monitoring, mobility and street lighting. SAREF4CITY provides a common core of general concepts for smart city data for the IoT.
CONCLUSIONS
Conclusions

NGSI-LD enables sharing of real world knowledge

• Many implementations; one ETSI spec for API for accessing relevant knowledge
• Model knowledge based on chosen abstraction
  • Knowledge graph with entities, properties, relationships and related meta information
• Find and Access relevant knowledge
  • Search for entity identifier or entity type
  • Filter results according to desired properties and relationships
  • “Navigate” along relationship links (FOAF)
  • Restrict results to a geographical location
  • Immediate results or asynchronous (subscriptions & notifications)
• Supports different deployment architectures
  • Centralized, distributed and federated

NGSI-LD can reference existing info

• Familiar entities represented by URIs
• Ontologies/Taxonomies linked as URIs
• Sensor data as historical series
Thank You!

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