Interworking between Information Silos with NGSI-LD API

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For: IoT Forum, IoT Week, Aarhus,, 17-21 June 2019

This work has received funding from the European Union’s Horizon 2020 research and innovation programme under the grant agreement No 732240 (SynchroniCity). Responsibility for the information and views set out in this document lies entirely with the author.
Smart Cities and Information Silos

Smart Cities need Information Management “between silos”
Information Management is being considered by all major SDOs

Application Space for a Data Exchange

Data-centric Smart City Model is necessary to resolve urban problems, ensure sustainable growth and accomplish a robust digital economy.

“Urban Data Management and Modeling in Korea Smart City - Dae Yeon Cho (TTA)” GSC-22, 26-27 March 2019
DATA USE AND MANAGEMENT – Standards of Data Hub

- Application of Standards for City Data Hub

E.g. oneM2M, TM Forum

- Data Model
- Ontology

Smart City Data Hub

- Semantics Module
- Analytics Module
- Data Service Module
- Other Modules

E.g. TM Forum

- Data Marketplace

E.g. ETSI ISG CIM

- Context-Info Interface

Connectivity Layer

- IoT Platform
- Proprietary City Platform
- Public Open Data
- Mass  IoT Edge

Data Core Layer

City Infrastructure

- Mobility Service
- Safety Service
- Energy Service
- City Admin Service

Business and Market Layer

Security & Privacy

- Mgmt.

- Proprietary City Platform
- Public Open Data
- Massive IoT Edge

NGSI-LD API

KS: National Standard

Global Standards

“Urban Data Management and Modeling in Korea Smart City - Dae Yeon Cho (TTA)” GSC-22, 26-27 March 2019
SynchroniCity Architecture makes modules into solutions with “Minimal Interoperability Mechanisms”

This resulted from:

- Architecture guidelines and use case analysis
- Reference zones compliance
- Reuse of existing approaches:

  - high-level analysis of relevant European initiatives regarding IoT and Smart City platforms showed some commonalities, among the heterogeneous projects, in terms of technologies and functionalities.
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

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.

See https://docbox.etsi.org/ISG/CIM/Open
Examples how NGSI-LD could help in cross-domain Apps

e.g. Show the air-pollution geomap near you, whatever your city
e.g. Show the combined traffic/crime/rental "heat map"
to help locate a new appartment
to help city-planners
e.g. Combine public-transport usage data with "special deals"
on tickets data, to help determine optimum usage?
e.g. Compare hospital admissions data, with weather and
pollution data, to help plan emergency services (i.e. reduce
spare capacity, but make sure surges can be covered)
Imagine a car crashes into a Lamppost and the police note the details and later look for video evidence.
NGSI-LD Example: Combined data exchange using Property Graphs

The police or town hall need to record the accident involving four kinds of entities, and actually four specific instances of them.
The police records show all involved in the accident: there is a set of “relationships”
NGSI-LD Example: Combined data exchange using Property Graphs

Vehicle

- rdf:type: Vehicle
- urn:nssi-ld: Vehicle: A4567
- brandName: "Mercedes"
- observedAt: 2017-07-29T12:00:00Z

LegalEntity

- rdf:type: Org:Officer
- urn:nssi-ld: Org:Officer123

StreetFurniture

- rdf:type: SmartLamppost
- location: [8.672, 49.398]
- trafficFluidity
- hasAttached

Sensor

- rdf:type: Sensor
- urn:nssi-ld: Sensor: Cam1
- location: [8.672, 49.398]
- accuracy: 5%
- trafficFluidity

Info is noted for each entity!
Interworkable records: NGSI-LD Information Model

ENTITIES

RELATIONSHIPS

PROPERTIES

CORE SPATIAL PROPERTIES

CORE TEMPORAL PROPERTIES

ANY ONTOLOGY (CONTEXT) YOU NEED

(but don’t multiply complexity!)
Interworkable records: NGSI-LD Information Model

Entity

Resource (rdfs:Resource)

Property (rdf:Property)

Property

rdfs:subClassOf

rdfs:subClassOf

rdfs:subClassOf

Relation-ship

hasObject

hasValue

Value

Literal (rdfs:literal)

Entity

GeoProperty

rdfs:subClassOf

rdfs:subClassOf

coordinates (for geoJSON)

location

observation Space

operation Space

start

time
createdAt

Temporal Property

TimelInterval

rdfs:subClassOf

rdfs:subClassOf

rdfs:subClassOf

Geometry

Point

LineString

Polygon

Relation-ship

rdfs:subClassOf

rdfs:subClassOf

rdfs:subClassOf

Resource

a = rdf:type

rdfs:domain

rdfs:range

ANY ONTOLOGY (CONTEXT) YOU NEED (but don’t multiply complexity!)
Interworkable records: NGSI-LD Information Model

RDF/RDFS Grounding

NGSI-LD Meta-Model

NGSI-LD Cross-Domain Ontology

UNDER CONSTRUCTION
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
✔️ URI pointing to another entity (target of relationship).
Information-centric with developer-friendly NGSI-LD

- Information-centric
- Developer-friendly NGSI-LD

A.I.

Machine Reasoning Systems

APPs

Data Publication Platforms

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

User Apps

EXEMPLARY: Citizen Complaints Photo-App Application

Context Information Management

Information Systems

APP

APP

APP

IoT

Open Data

Proprietary Data

ISG CIM API (NGSI-LD)

Wi-Fi 5G LPWAN
Example: Entity "Vehicle" and its @context in NGSI-LD

```json
{
    "id": "urn:ngsi-ld:Vehicle:A4567",
    "type": "Vehicle",
    "brandName": {
        "type": "Property",
        "value": "Mercedes"
    },
    "inAccident": {
        "type": "Relationship",
        "object": "urn:ngsi-ld:SmartLamppost:Downtown1",
        "observedAt": "2019-05-29T12:14:55Z",
        "providedBy": {
            "type": "Relationship",
            "object": "urn:ngsi-ld:Org:Officer123"
        }
    }
}
```

"@context": [
    "https://example.org/vehicle/my-user-terms-context.jsonld"
]

Info can be sent using NGSI-LD messages
Conclusions re Information Management

So many Smart City services ....

So many issues in enabling exchange of meaningful, usable information

Do not wait for perfection ...

Get started, standardise, collaborate ...
Collaborations for Smart Cities and Information Management

- User Apps
- Applications
- Applications
- Applications
- GSMA
- (5G)
- FIWARE
- Provenance
- ISG CIM API [NGSI-LD]
- IoT
- SAREF
- Context Information Ontologies
- Context Information Ontologies
- Context Information Ontologies
- OGC
- Proprietary Data
- BDVA
- Open Data
- Usage Data
- INSPIRE
- ISG CIM API [NGSI-LD]
- ITU-T FG DPM
- + EU H2020 Projects
- + Smart City organisations: OASC, EUROCITIES
Thank you!