SAREF4CITY: A REUSE-BASED ONTOLOGY DEVELOPMENT APPROACH TO BE REUSED

María Poveda-Villalón (UPM mpoveda@fi.upm.es)
With inputs from: Raúl García-Castro (UPM), Paola Espinoza Arias (UPM), Laura Daniele (TNO)

Connected Smart Cities Conference. Brussels, 17 January 2019
• Reuse
  • Models
  • Technology
  • Guidelines
• Communication & Review
  Modular approach
METHODOLOGICAL APPROACH

Ontological Engineering resources:
http://lot.linkeddata.es
**REQUIREMENTS SPECIFICATION**

**Related initiatives & stakeholders search**
- AENOR
- FEMP
- FIWARE
- VICINITY
- EXPRESO
- Madrid town hall
- ISA2 vocabularies

**Identify categories**
- Territory
- Location
- Equipment
- Events
- Public service
- Service request
- KPI
- Organization
- Business
- Transport
- Traffic
- Parking
- Tourism

**Resources search**
- Ontologies
- Data models
- Datasets
- Standards

**Reverse engineering & generalization**
- Territory (26)
- Location (20)
- Equipment (7)
- Events (10)
- Public service (15)
- Service request (18)
- KPI (23)
- Organization (15)
- Business (9)
- Transport (7)
- Traffic (13)
- Parking (6)
- Tourism (17)

Reviewed after OASC Connected Smart Cities Conference 2018
Reviewed after IoT Week Bilbao in June 2018
REQUIREMENTS SPECIFICATION

Requirements:
- EU Metadata Registry
- FEMP Open Data Guide exemplary datasets
- FIWARE data model for KPIs
- ISA Programme Location Core Vocabulary
- Joinup Core Public Organization Vocabulary
- Joinup Core Public Service Vocabulary
- OGC CityGML
- OGC GeoSparQL
- schema.org
- Vocabulary referenced by AENOR UNE 178301:2015
- W3C Registered Organization Vocabulary
- W3C WGS84 Geo Positioning vocabulary
- ISO/IEC 30182:2017
- ITU-T Y.4903/L.1603 (10/2016)
IMPLEMENTATION

• **Conceptualization:** patterns definition from requirements for each domain

- **Graphical representation:**
  - **Name:** City Object
  - **Description:** This pattern provides a model for an object that belongs to a city.
  - **Requirements:**
    - CITY-15: A city object can be defined by a geometry.
    - CITY-16: A city object can be located in a given point.
    - CITY-17: A city can have city objects.
    - CITY-18: Each city object can have a location.
    - CITY-19: Some specific types of city objects can be automated external devices (hence, baskets, street lights, etc.), cameras, or monuments.
    - CITY-20: A spatial thing can be a city object.

- **Graphical representation:**
  - **Name:** Event
  - **Description:** This pattern provides a model for something that occurs in a certain place during a particular interval of time.
  - **Requirements:**
    - CITY-21: An event is something that occurs in a certain place during a particular interval of time.
    - CITY-22: An event can have a starting date.
    - CITY-23: An event can have an ending date.
    - CITY-24: An event can have a starting hour.
    - CITY-25: An event can have an ending hour.
    - CITY-26: An event can take place in a given location.
    - CITY-27: An event can have a given accessibility type.
    - CITY-28: An event can be organized by one or more agents.
    - CITY-29: There can be different types of events.
    - CITY-30: An event can contain sub-events.
    - CITY-31: There can be recurrent events.

- **Graphical representation:**
  - **Name:** Measurement
  - **Description:** This pattern provides a model for a method to represent the measured value made over a property.
  - **Requirements:**
    - CITY-62: A measurement can be made by a device.
    - CITY-63: A device can be a sensor, actuator, etc.
    - CITY-64: A measurement can be related to certain property.
    - CITY-65: A property can be light, pressure, height, etc.
    - CITY-66: A property can belong to a feature of interest.
    - CITY-67: A measurement can have a result value in a given timestamp.
    - CITY-68: A measurement can be measured in a certain unit of measurement.
Accepted journal peer-reviewed paper

https://doi.org/10.3390/app9010032

**Ontological Representation of Smart City Data: From Devices to Cities.**
*Applied Sciences, 9*(1), 32.
REUSE OF MANY RESOURCES AND TECHNOLOGY

Linked Open Terms Methodology [http://lot.linkeddata.es/](http://lot.linkeddata.es/)

- Ont. Devel.
- Users
- Experts

- Ont. Devel.
- Users
- Experts

- Ont. Devel.
- Users
- Experts

Openly managed in [GitHub](https://github.com):

Shared in online spreadsheets

Evaluation

- Own URI
- purl, w3id, etc.
- Content negotiation
- Registry

Openly reported in GitHub issue tracker: new needs, bugs, etc.
CONCLUSIONS AND FUTURE STEPS

- Reuse of existing models, ontologies, tools and other resources
- Patterns identification
- Overall model conceptualization
- On going implementation
  - Share and review → contribute!
- To be published in February 2019
- To be included in http://saref.linkeddata.es
- Paving the way for other SAREF extensions → SAREF ecosystem
Thank you for your attention.
You can now USE & CONTRIBUTE!

SAREF extension for Smart Cities

Ontology URL: https://w3id.org/def/saref4city
Revision: 0.4
Authors: http://w3id.org/people/mariapoveda
http://www.garcia-castro.com/foto.rdf#me
Publisher: http://www.oeg-upm.net/
License: http://w3id.org/def/license/CC0-1.0
Provenance of this page

Abstract

This ontology extends the SAREF ontology for the Smart Cities domain. This work has been developed in the context of the STF 534: https://gforge.etsi.org/GF/STF534/STF534HomePages/STF534.aspx, which was established with the goal to create three SAREF extensions, one of them for the Smart Cities domain.

Table of contents

- 1. Introduction
  - 1.1. Namespace declarations
- 2. SAREF extension for Smart Cities: Overview
- 3. SAREF extension for Smart Cities: Description
  - 3.1. Cross reference for SAREF extension for Smart Cities classes, properties and datatypes
    - 3.1.1. Classes
    - 3.1.2. Object Properties
    - 3.1.3. Data Properties
- 4. References
- 5. Acknowledgements

https://w3id.org/def/saref4city
https://github.com/mariapoveda/saref-ext/issues