Subject :

bicycle-sharing systems : OpenCycles

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OpenCycles

Introduction

- What is OpenCycles ?

OpenCycles

- ▶ **A web application that provides real time data about bicycles stations and the availability of bicycles.**

- ▶ **Developed using semantic web technologies like : StarDog triple Store, Wikidata, JSON-LD, SPARQL.**

- ▶ **Support up to 27 city in France and other countries.**

- ▶ **Provide extra data near bicycles stations like Restaurants and more.**

Technologies and Vocabulary

- List of Semantic Web technologies used ?
- Vocabulary definition and usage of protégé.

Technologies

- **Stardog :** is a commercial RDF database: insanely fast SPARQL query, transactions, and world-class OWL reasoning support, Better support for javascript provides a documented API.

- **Wikidata :** Knowledge base used to provide additional data in the OpenCycles app like restaurants.

- **Protégé :** Protégé is a free, open source ontology editor and knowledge-base framework, we have used it to define our vocabulary and simulate some simple data.

Vocabulary definition

```
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@base <http://example.org/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix rel: <http://www.perceive.net/schemas/relationship/> .
@prefix ex: <http://example.org/> .
@prefix sh: <http://schema.org/> .


<#bicycle_station>
  sh:id "lyon01";
  rel:part_of ex:bicycle_sharing_system ;
  foaf:name "02- LES HALLES" ;
  sh:city "amiens" ;
  sh:address "Rue J Natiere" ;
  sh:latitude "49.896032388592566"^^xsd:decimal;
  sh:longitude "2.295043974872919"^^xsd:decimal;
  ex:nb_bike_stands "20"^^xsd:integer ;
  ex:available_bike_stands "10"^^xsd:integer ;
  ex:available_bikes "10"^^xsd:integer ;
  ex:last_update "1573376120000"^^xsd:decimal;
```

Using Protégé

- We have used protégé to create and define our vocabulary.

- We have also used it to create some sample data to simulate some cities before we developed the data converter and parser.

```
@prefix : <https://www.emse.fr/~zimmermann/Teaching/SemWeb/bicycle_stations.owl#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix xml: <http://www.w3.org/XML/1998/namespace> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@base <https://www.emse.fr/~zimmermann/Teaching/SemWeb/bicycle_stations.owl> .

<https://www.emse.fr/~zimmermann/Teaching/SemWeb/bicycle_stations.owl> rdf:type owl:Ontology .


#############################################################
#    Data properties
#############################################################


###  https://www.emse.fr/~zimmermann/Teaching/SemWeb/bicycle_stations.owl#address
:address rdf:type owl:DatatypeProperty ;
         rdfs:domain :BicycleStation ;
         rdfs:range xsd:string .



###  https://www.emse.fr/~zimmermann/Teaching/SemWeb/bicycle_stations.owl#available_bike_stands
:available_bike_stands rdf:type owl:DatatypeProperty ;
                       rdfs:domain :BicycleStation ;
                       rdfs:range xsd:integer .



###  https://www.emse.fr/~zimmermann/Teaching/SemWeb/bicycle_stations.owl#available_bikes
:available_bikes rdf:type owl:DatatypeProperty ;
                 rdfs:domain :BicycleStation ;
                 rdfs:range xsd:integer .
```
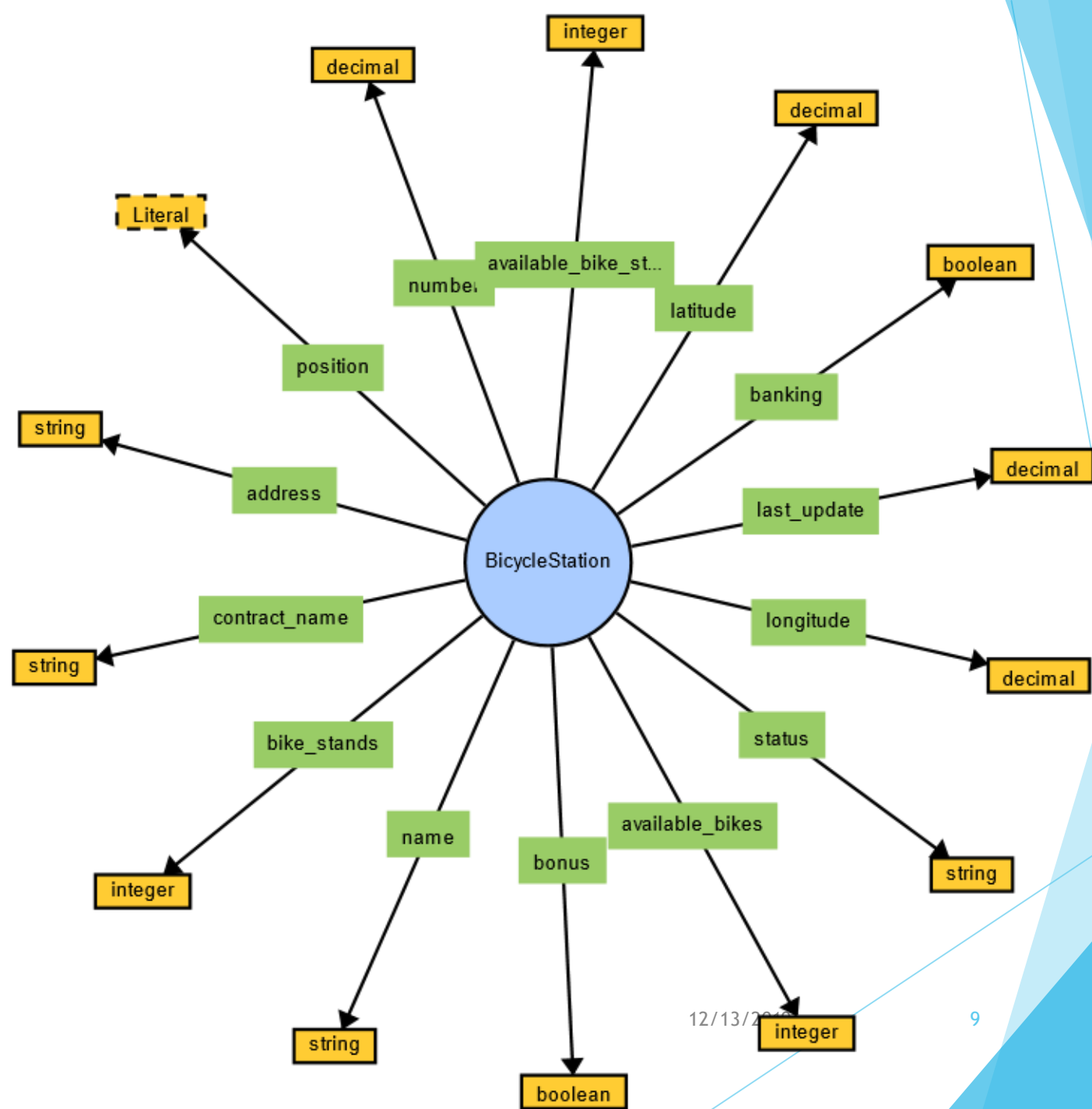
Ontology

Data Conversion and Metadata

- Source of data, APIs and ,conversion.

- Usage of JSON-LD.

Data Conversion

- We have used https://developer.jcdecaux.com/ api that provides real time data of multiple cities around the world, we have also used download.data.grandlyon.com.

- We extract the json data from the APIs and we insert it to Stardog triplestore.

- Created a universal parser the can parse any kind of json data:
  - The only condition is that the user need to specify the path to the data inside the json file.

Supporting Heterogeneous data

```
{
    "link": "https://api.jcdecaux.com/vls/v1/stations?contract
        =amiens&apiKey=d5e621dfff04f880bfabac0c12a3967ac4e34f01",
    "city": "Amiens",
    "path": "",
    "station": {
        "id": "number",
        "lat": "position.lat",
        "lng": "position.lng",
        "name": "name",
        "address": "address",
        "nb_bike_stands": "bike_stands",
        "last_update": {
            "item": "last_update",
            "format": "unix"
        }
    },
    "available": {
        "link": "",
        "id": "number",
        "available_bikes": "available_bikes",
        "available_bike_stands": "available_bike_stands",
        "last_update": "last_update"
    }
}
```

JSON-LD metadata

- We create JSON-LD metadata on every bicycle station.

- Whenever we click on a station we generate JSON-LD data.

- We have used JSON-LD instead of RDFa because it was easier for us to integertae in the web page

```
{
    "@context": "https://schema.org",
    "@type": "BikeStation",
    "available_bikes": 4,
    "available_bike_stands": 11,
    "nb_bike_stands": 16,
    "last_update": 1576170116,
    "name": "Stalingrad",
    "lat": 45.77435682899524,
    "lng": 4.85915458760836,
    "address": "Avenue Stalingrad",
    "city": "Lyon"
}
```

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SPARQL in Wikidata

```
SELECT ?place ?placeLabel ?image ?coordinate_location ?dist ?instance_of ?instance_ofLabel WHERE {
  SERVICE wikibase:around {
    ?place wdt:P625 ?coordinate_location.
    bd:serviceParam wikibase:center "Point(4.834304228535889,45.760751695058154)"^^geo:wktLiteral .
    bd:serviceParam wikibase:radius "1".
    bd:serviceParam wikibase:distance ?dist.
  }
  ?place wdt:P31 wd:Q11707.
  SERVICE wikibase:label { bd:serviceParam wikibase:language "[AUTO_LANGUAGE],en". }
  OPTIONAL { ?place wdt:P18 ?image. }
  OPTIONAL { ?place wdt:P31 ?instance_of. }
}
```

Demo

Project Demo