Why Geospatial Linked Open Data for Smart Mobility?

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Overview

• **Introduction:**
  - smart mobility and linked open Data
  - why geospatial Linked Open Data (LOD) for smart mobility?

• **Use Case**
  - cycling infrastructure in Flanders as Geospatial LOD

• **Result**
  - standardized workflow for conversion to LOD

• **Discussion and Conclusion:**
  - challenges and Way forward
Introduction

Smart mobility and Linked Open Data
Belgium: need for evolution towards smart mobility

Congested traffic, road accidents, accidental deaths
Smart Mobility
Why geospatial Linked Open Data for smart mobility?

Open Data and Data interoperability
Semantic Web (Web 3.0)

1998 - Tim Berners Lee
Linked Open Data (LOD)

A set of design principles for sharing machine-readable data on the Web for use by public administrations, business and citizens.  
(ISA European Commission, 2013)
LOD Principles

1. Use Uniform Resource Identifiers (URIs) as names of things

http://nl.dbpedia.org/resource/Fietspad
LOD Principles

1. Use Uniform Resource Identifiers (URIs) as names of things

2. Publish it on web using standard protocols (HTTP URI): people can look up those names

   HTTP URI: http://nl.dbpedia.org/resource/Fietspad

3. When someone looks up a URI, provide useful information, using the standards (RDF, SPARQL)
LOD Principles

RDF is a triple model i.e. every piece of knowledge is broken down into
(subject, predicate, object)

“Cycling Lane is the type of Cycling Infrastructure”

Subject (a URI), Predicate (Relationship) and Object (a URI/ Literal)

SPARQL Protocol and RDF Query Language
LOD Principles

1. Use Uniform Resource Identifiers (URIs) as names of things
2. Publish it on web using standard protocols (HTTP URI): people can look up those names
3. When someone looks up a URI, provide useful information, using the standards (RDF, SPARQL)
4. Include links to other URIs to allow discovery of more things
   
   Links at instance level (rdfs:seeAlso, owl:sameAs)

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Subject  Predicate  Object

Dbpedia-nl:Fietspad  owl:sameAs  Dbpedia:Segregated_cycle_facilities
Ontologies

• Syntax, Semantics, Taxonomy (classification), Thesauri (Associations), Ontology (Rules).

  “Formal, explicit specifications of a shared conceptualization”

  Studer (1998)

• **Conceptualization:** describe a concept: car, person, love, hate

• **Explicit:** All concepts must be defined

• **Formal:** Machine understandable

• **Shared:** Consensus about the ontology
Publishing Linked Open Data

5-star schema of Linked (Open) Data

https://www.w3.org/DesignIssues/LinkedData.html
Use case

Cycling infrastructure in Flanders Belgium as Geospatial LOD
Data

• Cycling infrastructure data: Supra-local Functional Cycling Route network

http://www.west-vlaanderen.be/kwaliteit/Leefomgeving/mobiliteit/fiterroutes/Pagina/fiterroutes/Paginas/frn.aspx
Geospatial Linked Data

GEOSPARQL

- An RDF/OWL vocabulary for representing spatial information;
- A set of functions for spatial calculation

Source: GeoSPARQL ontology. Source: Koubarakis and Kyzirakos (2012)
The process
RESULT

Standardized workflow for conversion to LOD
Standardized Workflow

- Created in BPMN for publishing of the cycling infrastructure data as Geospatial Linked Open Data
Ontology design sub-process

1. List vocabulary terms
2. Search suitable vocabularies in web
3. If Found Suitable Vocabularies, go to "Reuse Available Vocabularies";
   If Not, go to "Found Similar Vocabularies"
4. If "Found Similar Vocabularies", go to "Extend Existing Vocabulary";
   If Not, go to "Build vocabulary from Scratch"
Ontology design sub-process

<table>
<thead>
<tr>
<th>Classes</th>
<th>CycLeCharacteristics, CycLeInventory, QualityAssessment etc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Properties</td>
<td>hasQualityAssessment, hasCyclingDirection, hasServiceType etc</td>
</tr>
<tr>
<td>Imported properties</td>
<td>rdf:comment, rdf:label, ogc:hasGeometry, ogc:Geometry, ogc:asWKT etc</td>
</tr>
</tbody>
</table>
Linked Data Generation
Linked Data Generation

R2RML Mapping

RDF Conversion

• Geotriples: n-triples, ttl, json

<Subject> <Predicate> <Object>


Publication

www.mobiliteitsmonitor.be

Welkom

De Mobiliteitsmonitor is een centrale toegangspoort voor indicatoren over mobiliteit in Vlaanderen.
Geo-Linked data Provider
Discussion and Conclusion

Challenges and Way forward
Lesson Learned: Geospatial LOD

- Initial stage of development
- Different software tends to use different vocabularies
- Broken links
Smart Mobility: Road ahead

• Combining and accessing data from different sources---Best practice LOD
  
  o Involving citizens: dangerous cycling path (not registered in Road accidents statistics) → crowd sourcing
  o Suitability for new type: mobility scooters,
  o Real-time traffic information
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Thank you

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