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Semantic linking of georesources

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Background/Overview

Building upon OGC Discussion Paper DP 08-167 “Semantic annotation in OGC Standards”

- Defining the need and formalizing levels of semantic annotations in GIS (meta)data
 - Analyzing existing GIS standards for the possible inclusion of such annotations
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- This paper extends the discussion to mass market standards such as HTML, Atom, applied in the scope of a CSW catalogue with a REST interface
 - Semantic querying will also be discussed; an OpenSearch –based solution will be presented



Reminder

From DP 08-167 :

- There exists domain taxonomies out there, and it must be possible to leverage them to tag geo-resources
- The minimal assumption is that any concept from a taxonomy can be identified by URI
- Semantic annotations express the fact that a resource is 'classified by' a given concept, i.e. satisfy a RDF tuple such as

```
<resource> <rdf:Type> <conceptURI>
```



Reminder

- GIS Standards such as ebXML, ISO19139, GML, KML, SensorML, WMC, ... were analyzed
 - resulted in proposals on how to express semantic annotations in those standards *in their current state*



Usecase

Why extend the discussion to HTML or Atom ?

- They are supported and crawled by **common search engines**; using them leverages the power of such tools
- They are suited to extend the geo usecase and integrate it into wider web usecases
- Because of their wide adoption, they form a carrier for a **web of semantically connected resources**
- Example use case : ongoing **OWS-7** project, where various crowd-sourced resources (geo and non geo) have to be annotated, catalogued and searched using existing taxonomies



HTML

- Question: how to include semantic annotations into HTML ?
- The 'rel' attribute (on `<a>` and `<link>` elements) looks the most suited to express such annotations
- From the HTML spec : *“The 'rel' attribute describes the relationship from the current document to the anchor specified by the 'href' attribute”*
- HTML defines a finite set of 'rel' values, but also allows extensions.



HTML

- Using the RDF vocabulary, a semantic annotation may be expressed as

```
<link rel="rdf:type" href="urn:ogc:serviceType:WFS">
```

which is an instance of the RDF tuple

```
<resource> <rdf:type> <conceptURI>
```

where `resource` is the resource represented by the HTML document

Q : Is `rdf:type` the right URI to use ?

- (a URN as above may look strange in a HTML link, but the spec allows for any URI, and resolvability is not required)



HTML

- Extending the use of `rel` to refer to any concept makes it possible to have *semantically qualified links* :

```
<link rel="<associationTypeURI>"  
      href="<associatedObjectURI>" >
```

(notice the match with the ebRIM associations model)

- Example :

```
<link rel="http://www.geonames.org/ontology#nearby"  
      href="http://sws.geonames.org/6619832" >
```

meaning the resource represented by the current document is nearby Trafalgar Square (represented by its geonames URI)



HTML

On Using `<a>` or `<link>` : What is the right element to use ?

- Using `<a>` allows semantic qualification of any link in a HTML representation
- Using `<link>` (in the `<head>` section) centralizes semantic links as being part of the resource metadata
- Check out :
<http://projects-eu.erdas.com/ows7-catalog/content/catalog/items/8aacfe09266f224101266f3c71c50198>



Atom

- Atom is interesting as a simple and widespread XML format for the representation of resources (originally for web feeds and syndication of web content). AtomPub builds upon Atom and is an Atom-based protocol for the update of resources.
- Atom supports also the `link` element
- Atom also defines the `category` element :
it can be seen as a shortcut for

```
<link rel="rdf:Type" href="typeURI">
```



Querying

- Why OpenSearch
 - OpenSearch is becoming a de facto standard to describe web search engines capabilities, esp. for HTML/Atom
 - There exists an OpenSearch Geo extension
- → definition of OpenSearch Semantic extension
 - http://www.opensearch.org/Community/Proposal/Specifications/OpenSearch/Extensions/Semantic/1.0/Draft_1
 - its operators :
 - `classifiedAs` : find all results that match
`?result rdf:type <classifiedAsURI>`
 - `related, relation` : find all results that match
`?result <relationURI> <relatedURI>`
- Also : definition of a 'taxonomy' endpoint to easily fetch supported taxonomies



Querying

```
<?xml version="1.0" encoding="UTF-8"?>
<OpenSearchDescription [...]
  xmlns:semantic="http://a9.com/-/opensearch/extensions/semantic/1.0/">
  <Url type="application/atom+xml"
    rel="http://a9.com/-/opensearch/extensions/semantic/1.0/taxonomies"
    template="http://mysearchengine.com/taxonomies.atom?
      q={searchTerms}&
      identifier={semantic:identifier?}"/>

  <Url type="text/html"
    template="http://mysearchengine.com/content.html?
      q={searchTerms}&
      classifiedAs={semantic:classifiedAs?}&
      related={semantic:related?}&
      relation={semantic:relation?}& " />
```



Querying

- As with other OS extensions, interpretation of the search capabilities are partly left to the implementor
- For OS Semantic :
“If the search engine has semantic inference capabilities, the ‘classifiedAs’ operator **should match records that are classified by any concept that is equivalent to or a subconcept** of the specified concepts, where 'subconcept of' and 'equivalent to' are the formal relations defined in the RDF and OWL specification, resp.
`rdfs:subClassOf` and `owl:equivalentClass`.”
- This leaves the door open to both true semantic querying and search engines that have simpler querying capabilities (e.g. Google `related` parameter)



Querying

- Combining OpenSearch Geo and Semantic extensions provides a description for a geosemantic search engine
- Example :
[http://projects-eu.erdas.com/ows7-catalog/content/catalog/items?
classifiedAs=urn:ogc:serviceType:WebFeatureService&
bbox=-70,20,-50,30](http://projects-eu.erdas.com/ows7-catalog/content/catalog/items?classifiedAs=urn:ogc:serviceType:WebFeatureService&bbox=-70,20,-50,30)
- As other OpenSearch extensions, this Semantic extension is simple enough to be supported by existing search engines with semantic capabilities
 - GeoNames (using the GeoNames ontology)
 - DBPedia : supports full SPARQL queries; bridging required
 - Google Search : 'related' search parameter



Conclusion

- Combining HTML/Atom and OpenSearch (with a Semantic extension) provides a full solution
 - for the representation of semantically annotated and linked resources
 - for a querying solution that leverages these annotations and existing domain taxonomies
- This builds upon existing widely accepted building blocks, thereby easing the integration of semantic annotations and links into the large amount of existing data and tools



Conclusion

- Check out <http://projects-eu.erdas.com/apollo-catalog> for an OGC CSW catalog filled with public OGC resources and that implements the OpenSearch Semantic (and Geo, Time, ...) extensions
- Please check out the OpenSearch Semantic extension – feedback appreciated !

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