Geosemantics, Linked Spatiotemporal Data, and Geo-Ontologies IV

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ICCL Summer School 2013: Semantic Web - Ontology Languages and Their Use
OGC’s Spatial Data Infrastructures

- The Open Geospatial Consortium (OGC) has standardized a set of **markup languages** and **Web services** that jointly form a framework to develop and deploy data and processing infrastructures.
- Highly modular with many existing implementations
- Strict **conformance testing** to improve interoperability
- Well documented and transparent
- Steep learning curve; rather for GIS analysts than for the broad public
- Slow pace from innovation to standardization
Motivation for OGC and SDI in General

- **From** a set of deliberately incompatible and monolithic GIS
- **To** an inter-operable ecosystem of GIS components
- Redefine GIS as a framework of different modular services from a multitude of providers (SOA)
- Fundamental insight: collaboration strengthens the GIS market and improves its position compared to other communities (e.g., CAD)
- **Vertical and horizontal integration**
- **Standardize interfaces**, not software
Overview of Important OGC Standards

More than 40 standards including:

- **GML** - Geography Markup Language
- SensorML - Sensor Model Language
- KML - Keyhole Markup Language
- (O&M) - Observations and Measurements
- **SOS** - Sensor Observation Service
- SLD - Styled Layer Descriptor
- WCS - Web Coverage Service
- WFS - Web Feature Service
- WMS - Web Map Service & WMTS - Web Map Tile Service
- WPS - Web Processing Service
- **GeoSPARQL** - Geographic SPARQL Protocol and RDF Query Language
**General Web Service Architecture**

- **Abstract specifications** for conceptual foundations
- **Implementation specifications** for technical details
- Conformance testing between implementations
- Common Web Service parts defined in **OGC Web Services Common** specifications
- **GetCapabilities** operation: metadata about the capabilities provided by the service; self-description for late binding
- Service metadata document as respond to a GetCapabilities request
- Followed by client-server interaction, e.g., via GetFeatures, DescribeFeatureType, etc.
- Based on SOAP/WSDL or REST
Geography Markup Language

- XML-based markup language to encode information about geographic features
- First release in 2000, currently version 3
- Different profiles to simplify usage (e.g., Point Profile)
- GML predefined primitives include: Geometry, Feature, Time, Unit of Measure, Observation, etc
- Can also be used for sensor data (not just static features)
- Human and machine readable
- General purpose language (in contrast to KML)
GML Examples

```xml
<complexType name="RadioTowerType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="location" type="gml:PointPropertyType"/>
        <element name="floorSpace" type="gml:SurfacePropertyType"/>
        <element name="serviceArea" type="gml:SurfacePropertyType"/>
        <!-- ... -->
      </sequence>
    </extension>
  </complexContent>
</complexType>
```

```xml
<complexType name="PointType">
  <complexContent>
    <extension base="gml:GeometricPrimitiveType">
      <sequence>
        <choice>
          <element ref="gml:pos" />
          <element ref="gml:coordinates" />
        </choice>
      </sequence>
    </extension>
  </complexContent>
</complexType>
```

Examples from the GML 3.1 Specs.

GML is not only used to **markup data** but also on the **schema level**.
Spatial Data Infrastructures and the Semantic Web

A **Transparent** Semantic Enablement **Layer** for the Geospatial Web
**Transparent Encapsulation**

- Encapsulate SW reasoners by OGC Web Processing Services (WPS)
- Encapsulate SW ontology repositories by OGC Catalogue Service (CSW)
How are areas such as the „Rieselfelder“ affected by the gas plume?

- Encapsulation of Semantic Web reasoning services
Web Reasoning Service (WRS)

http://foo.bar/wrs?
  Service=WPS&
  Version=1.0.0&
  Request=Execute&
  Identifier=Similarity&
  DataInputs=[InputPolygon=@xlink:href=http://foo.bar/Rieselfelder.xml;
               Context=EnvironmentalFeature] &
  RawDataOutput=[SimilarFeatures]

<types>
  Rieselfelder
</types>

<ccsimilarity>
  NaturalReserve
  EnvironmentalFeature
</ccsimilarity>

<instances>
  ... SimilarFeatures.xml

load KB from WOS
Web Ontology Service (WOS)

Encapsulation of Semantic Web ontology repositories
Web Ontology Service (WOS)

http://foo.bar/wos?
Service=CSW&
Version=2.0.2&
Request=getRecords&
resultType=results&
typeNames=wos:Ontology&
constraint="wos:concept type http://foo.bar/../NaturalReserve"

RDF Repository

translation between
XML and ontology
language (RDF)

...