MODULE: Real Time Geospatial Applications

LESSON: OGC Sensor Observation Service

Manfred Mittlboeck
Department of Geoinformatics - Z_GIS
University of Salzburg
Austria

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Contents / Learning Objectives

- Introduction to OGC Sensor Observation Service
  - Important terms
- Introduction to the OGC Operations
  - Core & Extensions

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OGC Sensor Observation Service (SOS) - Definition

- The Sensor Observation Service (SOS) is a web service to query real-time sensor data and sensor data time series and is part of the Sensor Web.
- The offered sensor data comprises descriptions of sensors themselves, which are encoded in the Sensor Model Language (SensorML), and the measured values in the Observations and Measurements (O & M) encoding format.
- The web service as well as both file formats are open standards and specifications of the same name defined by the Open Geospatial Consortium (OGC).

OGC SOS & SensorML

- The Sensor Model Language (SensorML) is used within the SOS for encoding sensor metadata documents
  - *gml:description: Short textual description of the sensor or sensor system.*
  - *gml:identifier: Unique identifier of the sensor system.*
  - *sml:keywords: Terms which help to describe the sensor system and serve for discovery purposes*
  - *sml:identification: This element contains identifiers of the sensor system. (ID, Longnamte shortname ec.)*
  - *sml:classification: This element contains classifiers for the sensor system. (e.g. classifier term weather station)*
  - *sml:contacts: This element contains contact information about the operator of the sensor.*
  - *sml:featuresOfInterest: This element contains the real world entity, the feature of interest, which is observed by the sensor system.*
    - » <sams:SF_SpatialSamplingFeature> [e.g. Gauge Station]
    - » containing a <sf:sampledFeature> [River Salzach]
  - *sml:outputs: The outputs of the sensors attached to the sensor system. Depending on the observation types the outputs have to be described as*
    - » *swe:Quantity (in case of Measurement)*

OGC SOS & O&M

- the SOS is providing its data being designed to be extremely versatile using O&M

  - *gml:identifier*
  - *om:phenomenonTime*: this element describes the time instant or time period for which the observation contains sensor data;
  - *om:resultTime:* this element provides the time when the result became available
  - *om:procedure:* the identifier of the sensor instance that has generated the observation.
  - *om:observedProperty:* the identifier of the phenomenon that was observed.
  - *om:featureOfInterest:* an identifier of the geometric feature (e.g. sensor station) to which the observation is associated;
    - » <sams:SF_SpatialSamplingFeature> [e.g. Gauge Station]
    - » containing a <sf:sampledFeature> [River Salzach]
  - *om:result:* the observed value; the type of the result measurement
    - » [gml:MeasureType] - scalar numerical value with unit of measurement [<om:result uom="Cel">36</om:result>]

OGC Sensor Observation Service (SOS) - Usage

- Integration of spatio-temporal sensor-measurements into location enabled IT systems to enhance & enrich ‚situational awareness‘
- Integrate with GI Systems
- Based on the parameters „space” and „time“
- Leveraging standardized SOA based information infrastructures
- Guaranteeing semantic interoperability
- Strategy to support automated integration based on Service oriented distributed architectures using technical inter

OGC SOS – Terms

- **Measurement** - Set of operations having the object of determining the value of a quantity
- **Observed Property** - Facet or attribute of an object referenced by a name which is - observed by a procedure
- An **Observation Offering** groups collections of observations produced by one procedure
- **Procedure** - Method, algorithm, instrument, sensor, or system of these which may be used in making an observation
- **Sensor** - Entity that provides information about an observed property as its output

OGC SOS – Terms

- **Observation** - Act of observing a property
- **Feature of Interest (FOI)**
  - Sampling FOI - Sampling features are artefacts of an observational strategy (specimen, station, profile, swath, etc.)
    - e.g. the locality of a station
  - Sampled FOI – observed property of interest
    - e.g. world in the vicinity of the station
- An Observation provides a **result** whose value is an estimate of a property of the observation target, the feature of interest;

OGC SOS – Operations - Core

- The SOS has three so-called core operations that must be provided by each implementation.
  - **GetCapabilities** returns an XML service description with information about the interface (offered operations and endpoints) as well as the available sensor data, such as the period for which sensor data is available, sensors that produce the measured values, or phenomena that are observed (for example air temperature).
  - **GetObservation** allows pull-based querying of observed values, including their metadata. The measured values and their metadata is returned in the Observations and Measurements format (O & M).

OGC SOS – Operations - Core

- **DescribeSensor -** provides sensor metadata in SensorML. The sensor description can contain information about the sensor in general, the identifier and classification, position and observed phenomena, but also details such as calibration data.

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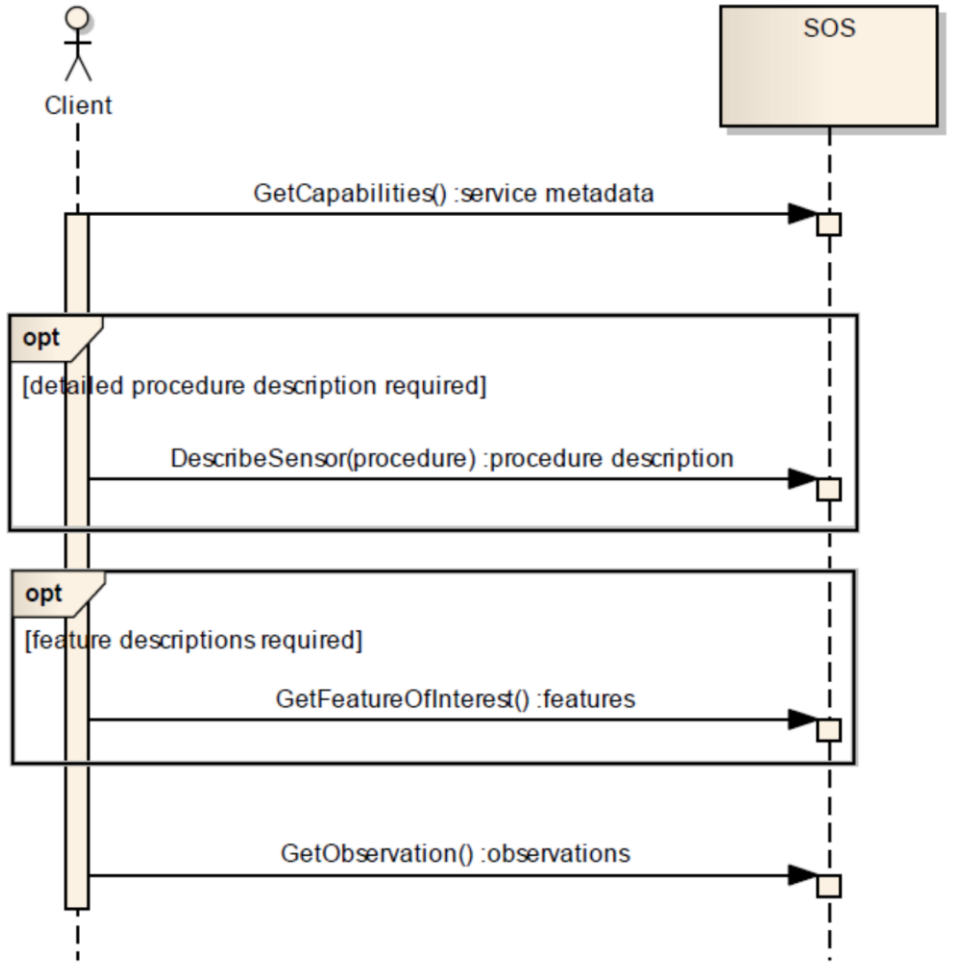
OGC SOS – Operations - GetObservetion

- conceptual model of the GetObservation operation

OGC SOS – Operations - Workflow of Observation Retrieval



OGC SOS – Operations - Extensions

- OGC SOS extensions can be defined to add further functionality
  - in OGC SOS 2.0 standard following extensions are defined
    - Transactional Extension (to allow for transactional support)
    - Result Handling Extension (to optimize data transfer load)
    - Enhanced Operations Extension
    - Binding Extension
    - Spatial Filtering Profile

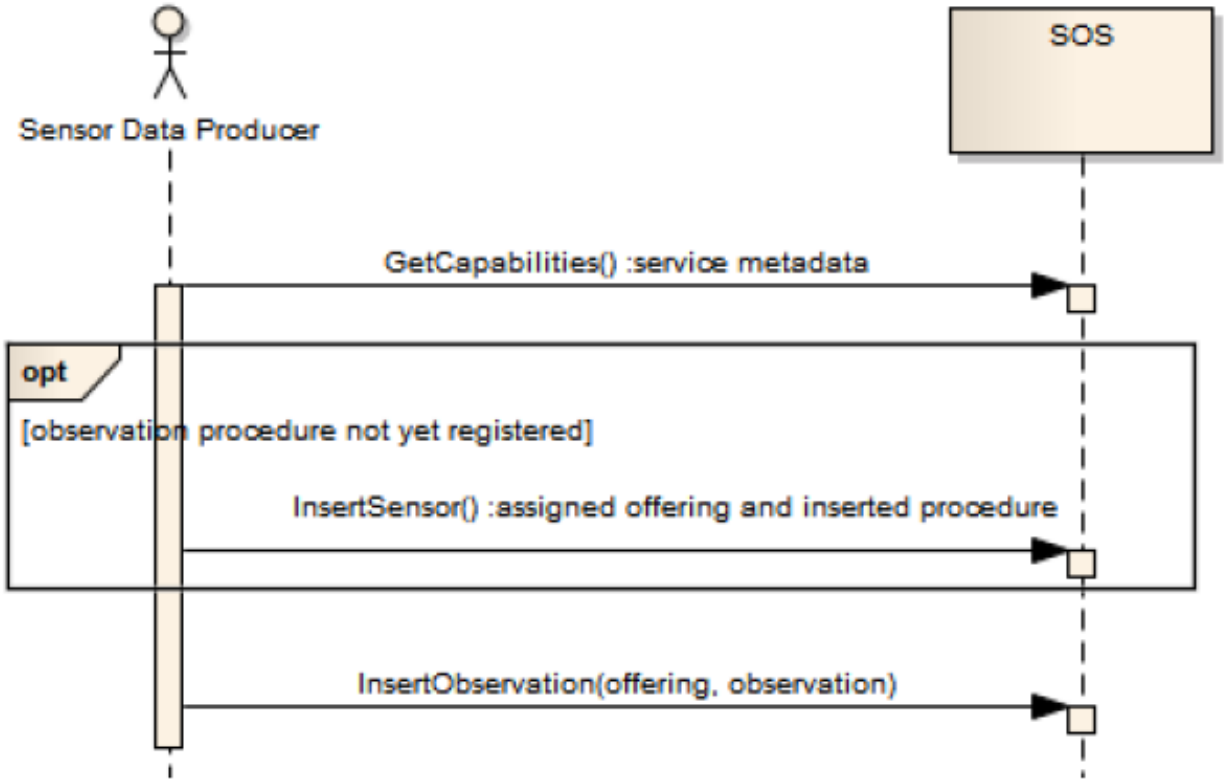
OGC SOS – Operations - Extensions

- *Enhanced Operations Extension*
  - **GetObservationByID**
    - provides access to observations from an SOS by passing only the ID of an observation.
  - **GetFeatureOfInterest** - provides direct access to the features of interest for which the SOS offers observations.

OGC SOS – Operations - Extensions

- *Transactional Extension*
  - **InsertSensor** – allows registration of new sensors at the SOS.
  - **DeleteSensor** – allows the deletion of registered sensors and all their associated observations.
  - **InsertObservation** – allows the insertion of observations in an SOS server.

OGC SOS – Operations - Workflow of Observation Insertion As



OGC SOS – Operations – InsertObservation Example

```
<env:Body>
  <sos:InsertObservation service="SOS" version="2.0.0">
    <sos:offering>obd_2_c3016b29-acf0-4d12-b0b2-5092ad53f5e1_ELM327_44</sos:offering><!-- (73-procedure_urn/B2) Wir haben ein 1:1 matching zwischen offering und procedure;-->
    <sos:observation>
      <om:OM_Observation gml:id="IDba4b9b57-2429-4fa7-b1b2-3fdb5367ee1b"><!--random UUID; Einsatzbereich nur im XML Dokument. -->
        <gml:description>obd_2</gml:description><!-- /B1 -->
        <gml:identifier codeSpace="">IDba4b9b57-2429-4fa7-b1b2-3fdb5367ee1b</gml:identifier><!-- /B2;ValueIdentifier muss im gesamten System unique sein; Wird f?r GetObservationById
        gebraucht -->
        <om:type xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement" />
        <om:phenomenonTime>
          <gml:TimeInstant gml:id="phenomenonTime">
            <gml:timePosition>2014-12-01T16:04:27Z</gml:timePosition><!--52north nimmt nur 3 Nachkommastellen (Tausendstel)-->
          </gml:TimeInstant>
        </om:phenomenonTime>
        <om:resultTime xlink:href="#phenomenonTime" />
        <om:procedure xlink:href="http://obd_2" xlink:title="obd_2" /><!-- (73-procedure_urn/B9) ,(72-procedure_title/B8)  -->
        <om:parameter>
          <om:NamedValue>
            <om:name xlink:href="http://www.opengis.net/def/param-name/OGC-OM/2.0/samplingGeometry"/>
            <om:value xsi:type="gml:GeometryPropertyType">
              <gml:Point gml:id="SamplingPoint1">
                <gml:pos srsName="http://www.opengis.net/def/crs/EPSG/0/4326">48.21492928 15.13258938</gml:pos>
              </gml:Point>
            </om:value>
          </om:NamedValue>
        </om:parameter>
        <om:observedProperty xlink:href="http://sensorml.com/ont/swe/property/SpeedValue" /><!--25/C1-->
        <om:featureOfInterest>
          <sams:SF_SpatialSamplingFeature gml:id="IDba4b9b57-2429-4fa7-b1b2-3fdb5367ee1b"><!--UUID only within xml file; this uuid is used by the other observations (foi) in this xml as a
          reference -->
            <gml:identifier codeSpace="">http://ispace.researchstudio.at/senser/elm327</gml:identifier><!--71-SpatioTemporalLocation_urn ist der value des identifier); -->
            <gml:name>obd_2</gml:name> <!-- 14/B10-->
            <sf:type xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingPoint" />
            <sf:sampledFeature xlink:href="http://obd_2" xlink:title="obd_2" /><!-- 15/ ; 14/ -->
            <sams:shape>
              <gml:Point gml:id="sampGeomID_tl2"><!--(64-sampGeom_id) -->
                <gml:pos srsName="http://www.opengis.net/def/crs/EPSG/0/4326" srsDimension="2" uomLabels="deg">48.21492928 15.13258938</gml:pos><!--(srs=65-sampGeom_srsName -->
              </gml:Point>
            </sams:shape>
          </sams:SF_SpatialSamplingFeature>
        </om:featureOfInterest>
        <om:resultQuality xlink:href="http://obd_2/qulityinformation" />
        <om:result uom="kmperh" xsi:type="gml:MeasureType">0</om:result>
      </om:OM_Observation>
    </sos:observation>
  </sos:InsertObservation>
</env:Body>
</env:Envelope>
```

OGC SOS – Operations - Extensions

- *Result Handling Extension*
  - **InsertResult** - allows the insertion of observation results in an SOS server. Before inserting, it is necessary that a template with observation metadata exists in the server.
  - **InsertResultTemplate** - allows the insertion of an observation template, containing the observation metadata and structure of the results.
  - **GetResultTemplate** - provides access to a template containing the structure of results.
  - **GetResul**t - provides access to an observation result without the observation metadata and the structure of the results

OGC SOS – Operations - Extensions

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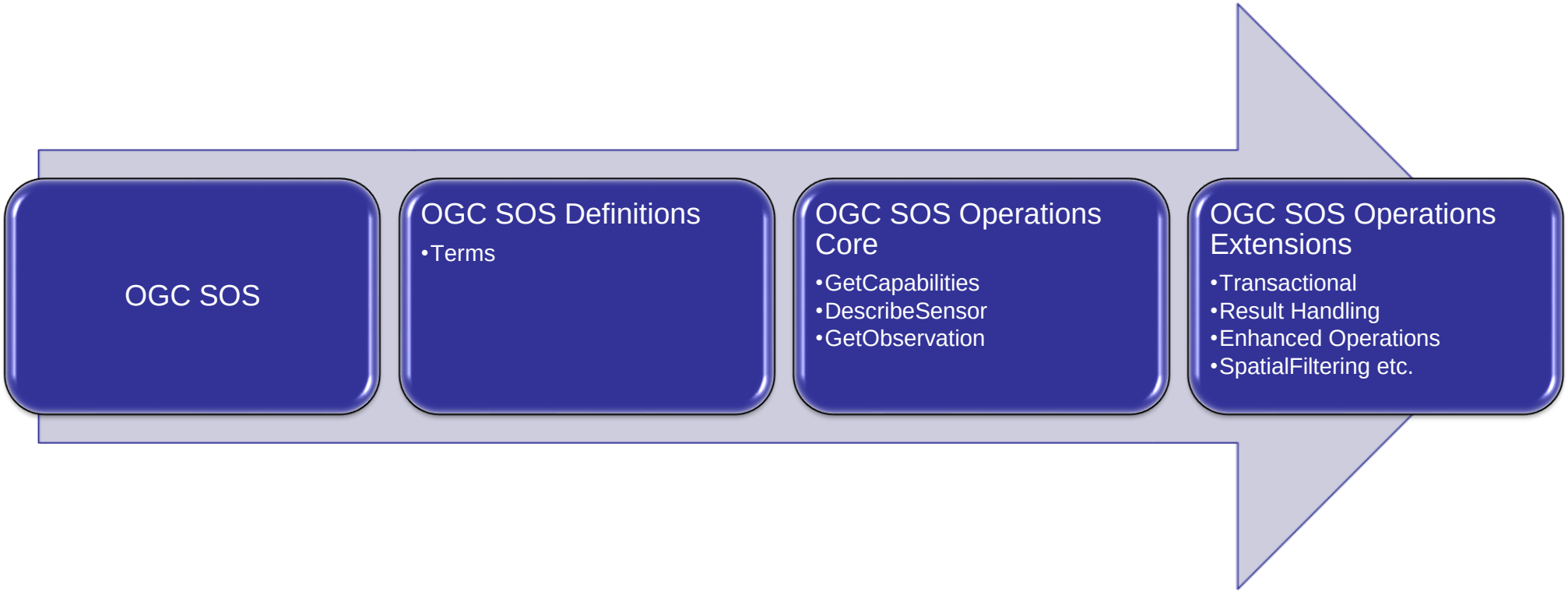
Summary


OGC SOS
OGC SOS Definitions
•Terms
OGC SOS Operations Core
•GetCapabilities
•DescribeSensor
•GetObservation
OGC SOS Operations Extensions
•Transactional
•Result Handling
•Enhanced Operations
•SpatialFiltering etc.

References

- Partners in ERASMUS+ Project ‘GeoServices-4-Sustainability‘

- Please see full list of references in the notes section