Sensor Web Enablement (SWE) standards

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Sensors Are Everywhere
The marine domain has been implementing Open Geospatial Consortium’s (OGC) Sensor Web Enablement (SWE) standards. Aim to:
- make all types of sensors, transducers and sensor data repositories discoverable, accessible and useable via the Web
- Include:
  - Sensor Model Language (SensorML),
  - Observations and Measurements (O&M),
  - Sensor Planning Service (SPS),
    - Observation feasibility and tasking
  - Transducer Markup Language (TML),
    - Low level sensor data streaming and actuator control
  - Sensor Alert Service (SAS),
    - Subscription to notifications
  - Sensor Observation Service (SOS) and
  - Web Notification Service (WNS).
Sensor Observation Service

• Web service
• API which allows querying observations, sensor metadata, representations of observed features.
  • Observations & Measurements (O&M): Modelling sensor observations and encoding them in XML
  • Sensor Model Language (SensorML): Modelling sensors and sensor systems for providing relevant metadata
SOS operations

- **GetCapabilities**, for requesting a self-description of a SOS instance
- **GetObservation**, for requesting sensor observations encoded in O&M
- **DescribeSensor**, for requesting information about the sensor itself encoded using SensorML
- **InsertSensor**, for connecting new sensors with the SOS
- **InsertObservation**, for inserting new observations for previously registered sensors
- **GetFeatureOfInterest**, for requesting the GML encoded representation of the feature that is the target of an observation
52° North SOS Test Client

Choose a request from the examples or write your own to test the SOS.

Examples

NOTE: Requests use example values and are not dynamically generated from values in this SOS. Construct valid requests by changing request values to match values in the Capabilities response.

NOTE: For security reasons, the transactional SOS operations are disabled by default and the Transactional Security is activated by default with allowed IPs 127.0.0.1. The transactional operations can be activated in the Operations settings and the Transactional Security can be deactivated in the Transactional Security tab of the settings.

Any Service ▼ Any Version ▼ Any Binding ▼
Load a example request ...

Service URL

http://linkedsystems.uk/52n-sos-webapp/service

Request

GET ▼ Content-Type Accept

Send
A common pattern: the observation model

An **Observation** is an **Event** whose **result** is an **estimate** of the **value** of some **Property** of the **Feature-of-interest**, obtained using a specified **Procedure**.

The **Feature-of-interest**:
Georeferenced abstraction of a real world feature carrying the observed property

sdn-userdesk@seadatanet.org – www.seadatanet.org
{
  "request": "GetObservation",
  "version": "2.0.0",
  "service": "SOS",
  "observations": [
    {
      "type": "http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement",
      "identifier": "1226291",
      "procedure": "http://linkedsystems.uk/system/instance/TOOL0022_1226291/",
      "offering": "http://linkedsystems.uk/system/offering/TOOL0022_1226291/",
      "observableProperty": "http://linkedsystems.uk/comproperty/71336/",
      "featureOfInterest": "http://linkedsystems.uk/cfoi/44/",
      "phenomenonTime": [
        "2004-06-22T22:00:00.000Z",
        "2005-07-08T09:45:00.000Z"
      ],
      "resultTime": "2005-07-08T09:45:00.000Z",
      "result": "https://www.bodc.ac.uk/data/open_download/series/1226291/odvnc/"
    }
  ]
}
SensorML

- can be better understood by machines,
- utilized automatically in complex workflows,
- and easily shared between intelligent sensor web nodes.
Characteristics

- SensorML flexible enough to describe sensors in all disciplines that a sensor exists
- "Soft typing" characteristic:
  - pre-define in schema every possible property
  - property types defined outside of the SensorML schema (typically within an online ontology) and then be used within SensorML as a value to the definition attribute.

Need for a centralised vocabulary

Need for team effort
Data Centre 1

Identification

- Manufacturer
- Model name
- Model number

Outputs

- salinity
- Temperature of the water column
- CO₂

Data Centre 2

Identification

- Manuf.Name
- Model
- UUID

Outputs

- psal
- temp
- Carb.diox
Data Centre 1

- GetCapabilities
- RegisterSensor
- DescribeSensor
- InsertObservation
- GetObservation
- GetFeatureOfInterest

Data Centre 2

- GetCapabilities
- RegisterSensor
- DescribeSensor
- InsertObservation
- GetObservation
- GetFeatureOfInterest

Show locations of all Aanderaa sensors

Manufacturer or Manuf.Name?

sdn-userdesk@seadatanet.org – www.seadatanet.org
Show all the observations of temperature of the water column?

temp
or
temperature of the water column?
Consequences

Soft typing

- Different terms for the same meaning
- Variations in the meaning of the same term
- Terms not properly defined
- Terms not resolvable
- Many different ontologies with variations on the names of same terms
- Terms not mapped with each other

→ Reduces interoperability and discoverability via the web
SensorML ontology

- SensorML creators have created the SensorML ontology to list these terms through the Marine Metadata Interoperability (MMI) project.
- Ontology Registry and Repository publishing a number of small project specific controlled vocabularies.
- Since different communities require different terminologies, the ontology can fulfill only a subset of the required concepts.
Solution

• “In order to achieve interoperability within and between various sensor communities, implementation of SensorML will require the definition of community specific semantics (within online dictionaries or ontologies) that can be utilized within the framework”

[OpenGIS® Sensor Model Language (SensorML) Implementation Specification]
Quote of the day

• "Alone we can do so little, together we can do so much."
  • —Helen Keller
Marine Community

SWE Marine Profiles

52 North Wiki for SWE Marine Profiles

National Environmental Research Council (NERC) Vocabulary Server 2.0

sdn-userdesk@seadatanet.org – www.seadatanet.org
SWE Marine profiles

- Group by partners from several projects and initiatives

- (AODN, BRIDGES, ENVRI+, EUROFLEETS/EUROFLEETS2, FixO3, FRAM, IOOS, Jerico/Jerico-Next, NeXOS, ODIP/ODIP II, RITMARE, SeaDataCloud, SenseOcean, X-DOMES, EMSODEV, SCHEMA)

- Aim at developing marine profiles of OGC SWE standards

- to serve as a common basis for OGC implementations
SWE Marine Profiles

This Wiki shall help to collect and discuss different approaches how OGC Sensor Web Enablement (SWE) standards (Sensor Observation Service (SOS), Observations and Measurements (O&M) and Sensor Model Language (SensorML)) are used in different projects and systems. The aim of this activity is to define a best practice and a set of profiles for the SWE standards for marine sensors and applications.

The Wiki is structured into several sub sections:

- **SweExamples**: Examples of SensorML, O&M and SOS usage
- **SweVocabularies**: Vocabularies for the Marine SWE Profiles
- **SweProfile**: Structure and proposed content of the Marine SWE Profiles
- **SosInventory**: Inventory of SOS Servers

Recent changes in SensorWeb/MarineProfilesForSWE web:
- Web Statistics
- Swe Vocabularies
- Web Left Bar
- Swe Examples
- Sos Inventory
- Swe Profile
- Web Home
- Web Preferences
- Web Notify
- Web Topic List
- Web Search
- Web Index
- Web Changes
- Web Topic Creator
- Web Search Advanced
- Web RSS
- more...

Attachments 50
Marine Sensor Web Enablement Profiles

https://odip.github.io/MarineProfilesForSWE/

- How to apply SWE standard for marine applications
  - Currently available:
    » Guidance on SensorML
    » Guidance on Vocabularies
  - Still work in progress
  - Will be continued beyond ODIP II

Marine Profiles of the OGC Sensor Web Enablement Standards

Documentation of Marine Profiles of the OGC Sensor Web Enablement Standards

If you would like to contribute to the development and maintenance of these profiles please contact the authors listed further below.

Contents

1. Overview
2. SensorML
3. Vocabularies
4. References

Authors

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- Christian Autermann, 52°North Initiative for Geospatial Open Source Software GmbH, c.autermann@52north.org
- PLEASE ADD YOUR NAME TO THIS LIST!

Acknowledgements

The profiles defined in this document have been developed within a series of research projects. Important European projects that supported the profile development comprise:
SensorML SWE Marine profiles live

- **BODC**

- **OGS**
  - An instance of a Wind Monitor-JR: [http://europa.ogs.trieste.it/OGS_SOS/SensorML_3_0/Sensor_V3_E2M3A_WIND.xml](http://europa.ogs.trieste.it/OGS_SOS/SensorML_3_0/Sensor_V3_E2M3A_WIND.xml)
  - An instance of SBE 37-SMP-ODO MicroCAT high-accuracy conductivity and temperature recorder: [http://europa.ogs.trieste.it/OGS_SOS/SensorML_3_0/Sensor_V3_E2M3A_CT.xml](http://europa.ogs.trieste.it/OGS_SOS/SensorML_3_0/Sensor_V3_E2M3A_CT.xml)
SMLE Editor
SOS Servers

• **OGS**
  
  • [http://nodc.ogs.trieste.it/sos/client](http://nodc.ogs.trieste.it/sos/client), where OGS publish marine observatories acquiring meteo-oceanographic data in *near* real time

• **BODC**
  
  • [http://linkedsystems.uk/52n-sos-webapp/](http://linkedsystems.uk/52n-sos-webapp/), where BODC publish historic ANIMATE project data as a demonstrator from placing fixed observatory data on an SOS server.
  
  • *Issue:* BODC provides access to out of band O&M measurements that currently cannot be displayed in Helgoland client.
  
  • *This will be an enhancement that 52North will be implementing the next few months.*
Term values

- Properties can have values:
  - Observable property: P01
  - Instrument Type: L05
  - Platform Type: L06
  - Sensor Models: L22
  - Roles: G04, C86
  - Feature of Interest: C19
  - Manufacturer: L35, C75
-- Instrument type --

URI       http://vocab.nerc.ac.uk/collection/W06/current/CLSS0002/
Identifier () SDN:W06::CLSS0002
Preferred label (en) Instrument type
Alternative label ()
Version Info () 1

Definition (en) Terms used to classify groups of sensors, instruments, sources of algorithmically computed data (numerical models) for the fields of ocean, water, SPM, sediment, rock, air or biota samples.

Deprecated () false

Narrower      http://sensorml.com/ont/csm/property/SENSOR_TYPE
Narrower      http://vocab.nerc.ac.uk/collection/L05/current/101/
Narrower      http://vocab.nerc.ac.uk/collection/L05/current/102/
Narrower      http://vocab.nerc.ac.uk/collection/L05/current/103/
Narrower      http://vocab.nerc.ac.uk/collection/L05/current/11/
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<td>SensorML History Event</td>
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<td><a href="http://vocab.nerc.ac.uk/collection/W08/current/">http://vocab.nerc.ac.uk/collection/W08/current/</a></td>
<td>SensorML Contact Section</td>
</tr>
</tbody>
</table>
Where next..

- O&M editor?
- O&M SWE Profiles
- Persistent Identifiers for Sensors and Platforms (RDA group)
- Schematron for SWE Profiles
Useful Links

- SWE Marine Profiles doc: https://odip.github.io/MarineProfilesForSWE/
- NVS2.0 SOAP service: http://vocab.nerc.ac.uk/vocab2.wsd1
- NVS2.0 RESTFul interface http://vocab.nerc.ac.uk/collection/
- NVS2.0 SPARQL endpoint http://vocab.nerc.ac.uk/sparql/
- NVS2.0 SensorML collections
  - http://vocab.nerc.ac.uk/collection/W03/current/
  - http://vocab.nerc.ac.uk/collection/W04/current/
  - http://vocab.nerc.ac.uk/collection/W05/current/
  - http://vocab.nerc.ac.uk/collection/W06/current/
  - http://vocab.nerc.ac.uk/collection/W07/current/
  - http://vocab.nerc.ac.uk/collection/W08/current/