# Sensor Metadata for Automated Integration of Sensor Resources into Research Data Infrastructures

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## Introduction

The study of global phenomena requires the analysis of data coming from multiple sources. Integrating sensor data However interoperability and data harmonization still remains an issue. The Sensor Web Enablement framework aims to address these interoperability challenges. It provides a set of protocols and standards to achieve an end-to-end integration of sensor data into Spatial data infrastructures.

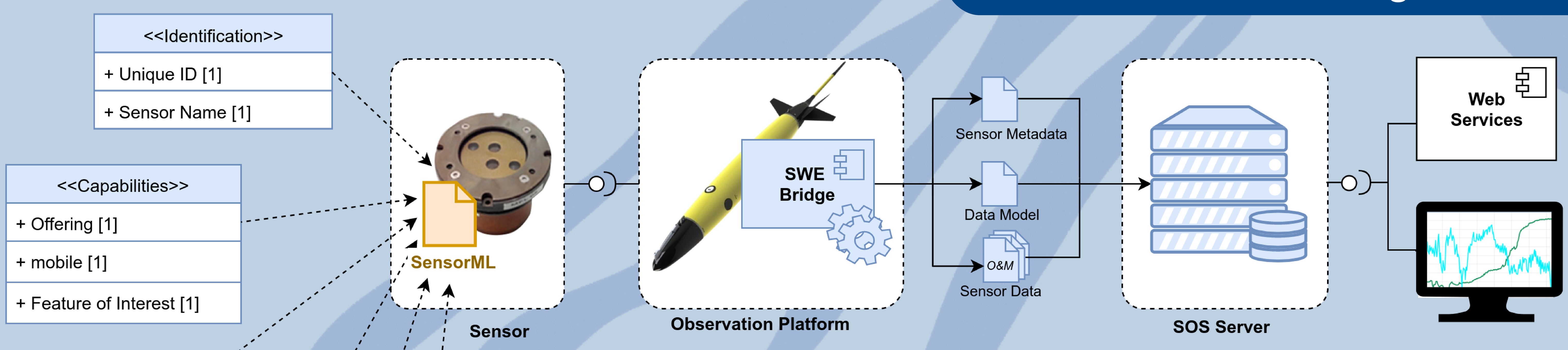
Due to the wide variety of marine observation platforms, a flexible, generic SWE-based architecture is proposed in order to integrate sensor data into data infrastructures in different scenarios.

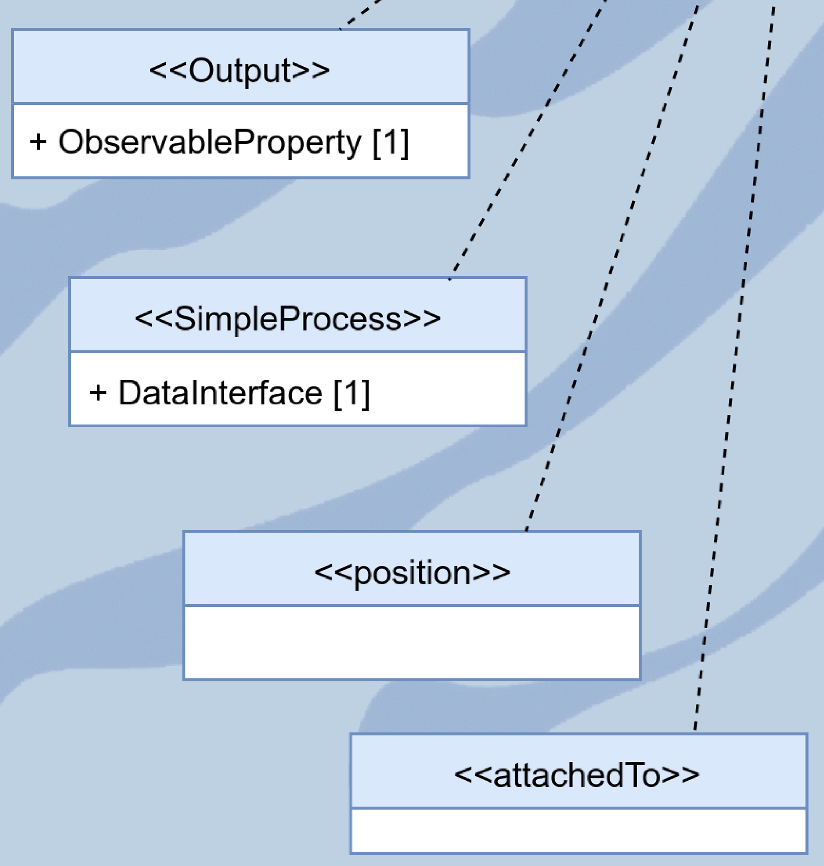
## Standards and Protocols

| | |
|---|---|
| 1. Sensor Detection | PUCK |
| 2. Identification | SensorML |
| 3. Configuration | SensorML |
| 4. Data retrieval | SensorML |
| 5. Registration | SOS |
| 6. Data Ingestion | O&M |

Several requirements are identified to achieve an automated integration of sensors into research data infrastructures, such as detection, identification, configuration, data retrieval, sensor registration and data ingestion. The SWE framework provides a set of standards and protocols to address these requirements: The **OGC PUCK Protocol** provides automatic sensor detection. The **SensorML** can encode all metadata, providing identification and specifying configuration and data retrieval methods. The combination of **SOS** (Sensor Observation Service) and **O&M** (Observations and Measurements) allow to register and publish sensor data into standard data services.

## Automated Sensor Integration




Each sensor has an associated SensorML file, embedded within its **PUCK Payload.** All the metadata required to **identify**, **configure** and **operate** a sensor is encoded within this SensorML file

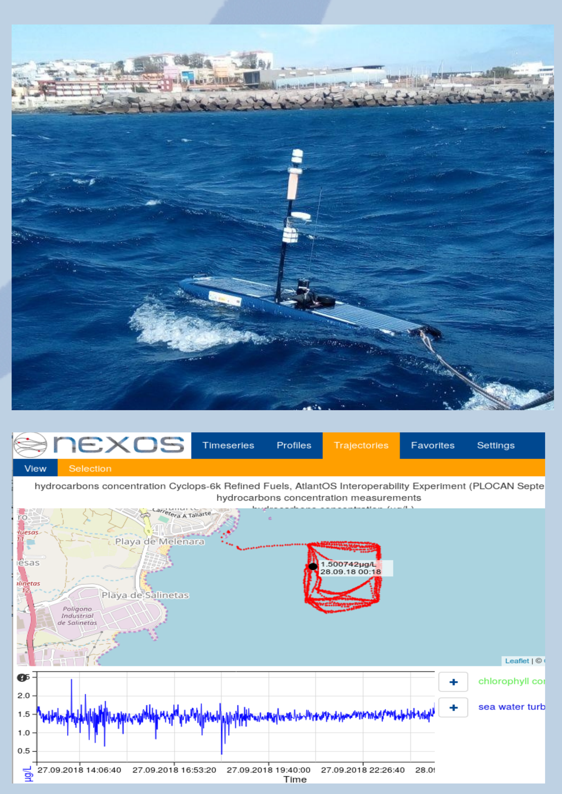
The **SWE Bridge** is an open-source, cross-platform tool that can retrieve and decode a SensorML file, configure and operate a sensor, providing **plug & play** integration. It has been successfully deployed in several platforms, such as underwater observatories, buoys and gliders. The SWE Bridge generates standard SOS-compatible files as output, including sensor registry metadata, data model and data files.

The sensor data and associated metadata can be automatically published by sending the SWE Bridge's output files to an **SOS server**. These files include sensor metadata (*Insert Sensor),* data model *(Insert Result Template)* and sensor data (*Insert Result).*

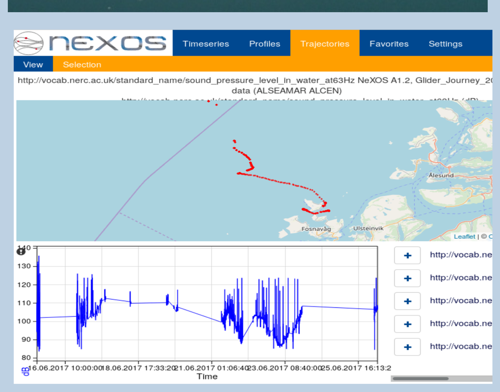
As the SOS server provides an standard interface to access both sensor data and metadata it can be used as a gateway to other services such as data visualization tools and data portals.

## Deployments

The **AtlantOS Interoperability Experiment** (September 2018) demonstrated the usage of SWE standards even in analog sensors. Three Cyclops-6k analog sensors were deployed in a Waveglider at Plocan (Canary Islands) using a Smart Cable. This cable, developed by Cyprus Subsea provides ADC conversion and implements the OGC PUCK protocol, enhancing the sensor's interoperability



Within the **NeXOS project** two PUCK-enabled sensors (Mini.1 Hydrocarbons detector and Smart Hydrophone A1) were deployed in a SeaExplorer glider at Runde Island, Norway (September 2017). The SWE Bridge was integrated within the glider controller. The acquired data was transmitted in near real-time using an Iridium link to a SOS server.



### Acknowledgments

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