ID41- SWE BRIDGE: SOFTWARE INTERFACE FOR PLUG & WORK INSTRUMENT INTEGRATION INTO MARINE OBSERVATION PLATFORMS

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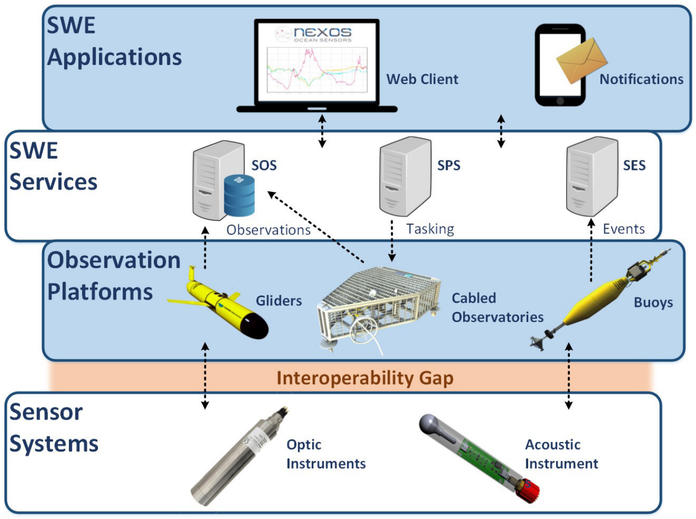
Abstract – The integration of sensor systems into marine observation platforms such as gliders, cabled observatories and smart buoys requires a great deal of effort due to the diversity of architectures present in the marine acquisition systems. In the past years important steps have been taken in order to improve both standardization and interoperability, i.e. the Open Geospatial Consortium's Sensor Web Enablement. This set of standards and protocols provide a well-defined framework to achieve standardized data chains. However a significant gap is still present in the lower-end of the data chain, between the sensor systems and the acquisition platforms. In this work a standards-based architecture to bridge this gap is proposed in order to achieve plug & work, standardized and interoperable acquisition systems.

Keywords – Platform integration, interoperability, standards, sensor web enablement.



I. INTRODUCTION

Marine sensor systems and marine observation platforms are generally developed by relatively small and medium sized companies and research institutions, resulting in a vast variety of architectures and implementations, usually custom-made and, in many cases, using proprietary communication protocols. Moreover, a given kind of sensor may be deployed into different platforms such as gliders, cabled observatories and smart buoys, to name a few.

Due to the large variety of sensor protocols and sensor interfaces, most applications integrate sensor resources through proprietary mechanisms, instead of using a well-defined integration layer. This manual bridging between sensors and applications requires an in-depth knowledge of the platform's hardware and software architecture, as well as knowledge of proprietary protocols implemented by the sensor [1]. In order to address this issue the Open Geospatial Consortium (OGC) has defined a set of standards that conform the Sensor Web Enablement (SWE).

The SWE framework has been progressively adopted by the ocean community as a standard approach to manage data in an interoperable way. Within this framework the Sensor Web is defined as "Web accessible sensor networks and archived sensor data that can be discovered and accessed using standard protocols and application programming interfaces" [2]. To achieve this objective a coherent and modular approach needs to be taken when treating both instrument data and metadata. Metadata is indispensable, as it may contain information about the validity of the acquired data, such as calibration coefficients, instrument identifier's, absolute errors, etc.

There are several implementation of SWE services and SWE applications that have been developed and presented to the community the past years. However, there is not any standardized mechanism to integrate a new sensor to an existing SWE infrastructure. Thus, the development of a specific driver to convert the sensor system proprietary output to standard SWE format is still required.

II. SWE BRIDGE OVERVIEW

The Sensor Web Enablement Bridge (SWE Bridge) aims to bridge the gap between sensor systems and observation platforms. It is an auto-configurable acquisition software meant to be deployed in any kind of observation platforms, fixed or mobile, whose main objective is to provide plug & work capabilities to any instrument, whether it is SWE-compliant or not.

Regarding its implementation, the SWE Bridge is a modular, light-weight and resource-efficient software component written in ANSI C in order to improve portability across platforms. Special attention has been paid in creating a hardware abstraction layer, which permits the use of different communications interfaces (i.e. RS-232, TCP/IP, UDP, etc.), operating systems (UNIX, Windows, etc.) and even different file systems. This design permits the deployment in a wide variety of observation platforms, with or without operating system.

III. SWE BRIDGE STANDARDS AND SERVICES

In order to provide plug & work capabilities to an acquisition system, four operations are required: instrument detection, description, configuration and data retrieval. The SWE framework provides a set of standards that can fulfil these requirements, i.e. PUCK protocol and SensorML standard.

The OGC PUCK protocol addresses installation and configuration challenges for sensors by defining a standard protocol to store and automatically retrieve metadata and other information from the instrument device itself. This protocol provides auto-identification and auto-definition capabilities to an instrument [3].

The Sensor Model Language (SensorML) provides a robust and semantically-tied means of defining processes and processing components associated with the measurement and post-measurement transformation of observations. This includes sensors and actuators as well as computational processes applied pre- and post-measurement. SensorML can provide an exhaustive definition of a sensor, instrument or even observation platform in structured format such as XML, providing a complete description of an instrument metadata [4].

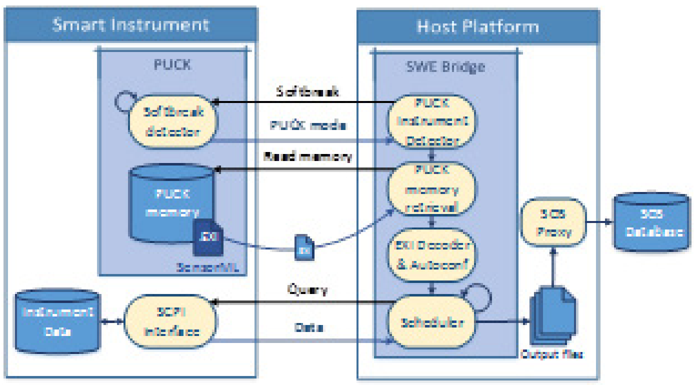
Nonetheless, the acquisition chain does not end at the observation platform, but the data has to flow from the instrument to the acquisition server where it will be stored. To continue the data chain a standard output compatible with the Sensor Observation Service (SOS) has to be provided [1].

IV. ARCHITECTURE

The SWE Bridge takes a SensorML description file as input, which describes a specific instrument: name, manufacturer, unique identifiers, communication interface, commands, etc. Thus, the whole communications layer and the instrument information are described within this file.

In the case of PUCK-enabled instruments, the SensorML file is stored within the instrument PUCK memory. This file can be the automatically retrieved by the SWE Bridge, without previous knowledge of the instrument. Otherwise if the instrument does not have this protocol implemented, the file can be stored locally in the Observation Platform. In this case the auto-detection capability is lost, while the auto-description and auto-configuration capabilities are maintained.

The SWE Bridge reads and decodes this file, auto-configuring itself with the retrieved information, establishing a communication link according to the instrument description. Afterwards, it starts getting data from the instrument in push or pull mode, using the instrument's proprietary communication protocol. The data retrieved from the instrument is stored in SWE-compliant XML files that can be directly injected in the SOS database.



V. CONCLUSIONS

The Sensor Web Enablement Bridge provides a powerful way to minimize the efforts for integrating an instrument into different platforms due to the capability of auto-detection and auto-configuration. Only a minimal effort is needed to generate a SensorML description file to integrate new sensors. Once the instrument is plugged to any Sensor Web Enabled platform data flows from the sensor to the SOS database automatically.

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