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NeXOS A1 Smart Hydrophone Integration into the Sensor Web Enablement Framework

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Introduction

Background

The objective of **NeXOS** project is to develop cost-effective, innovative, and compact multifunctional sensor systems in ocean optics, ocean passive acoustics and for an Ecosystem Approach to Fisheries (EAF), which can be deployed from mobile and fixed platforms. NeXOS addresses the whole data chain from the sensor to the end users adopting the Open Geospatial Consortium's (OGC) **Sensor Web Enablement** (SWE) framework to improve interoperability, data-sharing and multiplatform integration. Using this framework, the instrument data flows directly from the sensor to the **Sensor Observation Service** (SOS), where it is stored. This poster presents a case of use of this architecture, describing the integration of the NeXOS A1 Smart Hydrophone into the SWE framework, performed during the Oceanology International 2016 at ExCel London.

Figure 1. The marine environment (© 2013 NeXOS)

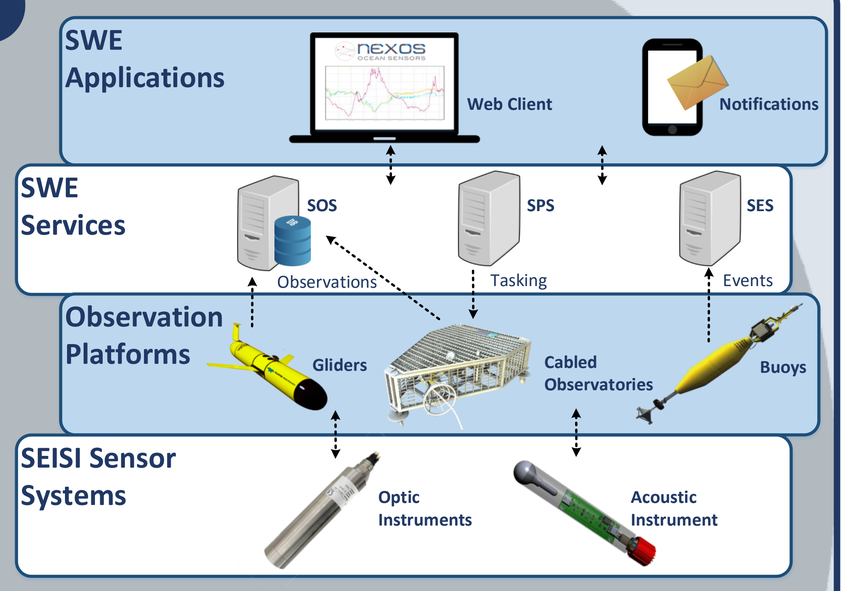

Figure 2. NeXOS Sensor Web Enablement Architecture

NeXOS A1 Hydrophone

Hydrophone Overview

The **NeXOS A1 Hydrophone** is a two-channel, low-power, low-noise, compact-sized, digital hydrophone designed to be deployed in mobile platforms such as profilers and gliders. Some of its main features are:

- **SEISI Interface** to enhance interoperability
- **RS-232** communications interface
- **SCPI** Commands interface
- **Embedded processing** function (i.e. **mammal detection,** instant **SPL** and **RMS**).
- **Sound sample** storage (.wav)

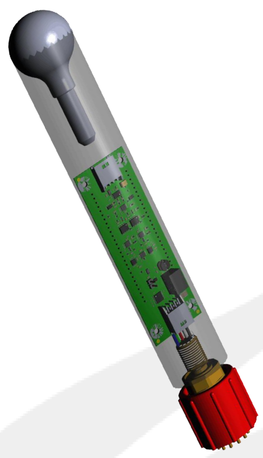

Figure 3. NeXOS A1 Smart Hydrophone

SEISI Interface

The **Smart Electronic Interface for Sensor Interoperability** (SEISI) consists of a set of standards and protocols aimed to enhance sensor interoperability and integration. The main functionalities of this interface are:

- **Instrument detection:** PUCK softbreak procedure
- **Instrument Identification:** PUCK Electronic Datasheet
- **Instrument Configuration** described in the SensorML auto-description file embedded in the PUCK Memory
- **Simple Measurements Operations** described within the SensorML file

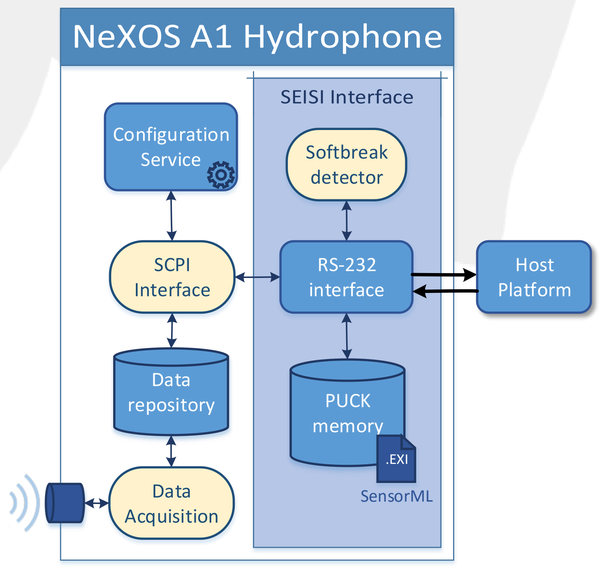

Figure 4. Hydrophone's Architecture

Integration and Deployment

Integration Scenario

The hydrophone was deployed using the **Smart Buoy** as a host platform, which has a Linux embedded computer with RS-232 and Wi-Fi interfaces, encapsulated into a buoy-shaped case. In order to provide web-capabilities to the hydrophone, the host platform executed the **Sensor Web Enablement Bridge**, which implements **auto-detection**, **auto-configuration** and **data collecting** processes services compatible with any SEISI Interface, acting as an **universal driver** for SEISI instruments. The **SOS Proxy** injected the observations gathered by the SWE Bridge into the **SOS database**. The acquired data was visualized in real-time using the open source 52º North's JavaScript **SOS client**.

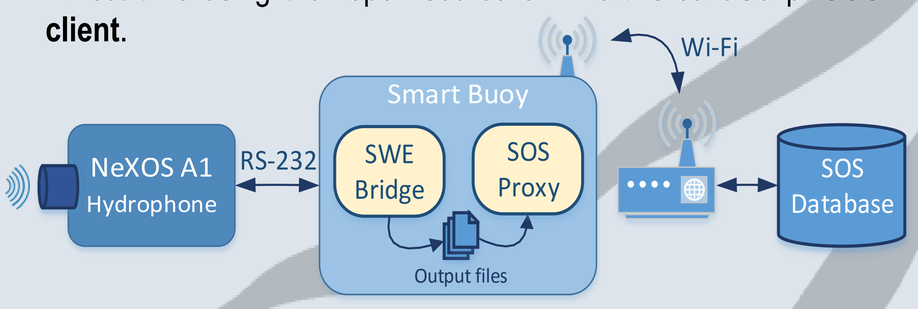

Figure 6. Integration scenario

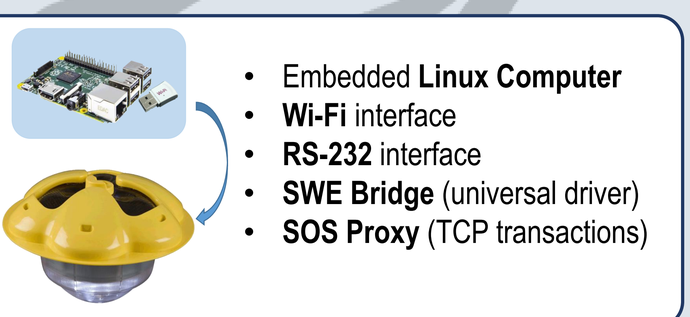

Figure 5. Smart Buoy

Figure 7. 52ºNorth SOS client

Interoperability

Once the instrument is connected to the platform, the **SWE Bridge** identifies an instrument using the **PUCK softbreak** detector. Then the SWE Bridge retrieves the **EXI-encoded SensorML** file stored within the PUCK memory and decodes it. According to the information stored within the SensorML file, the bridge **auto-configures** itself, **scheduling** the **tasks** described within the SensorML and starts querying the instrument. The acquired data is inserting the resulting observation into the **SOS server**.

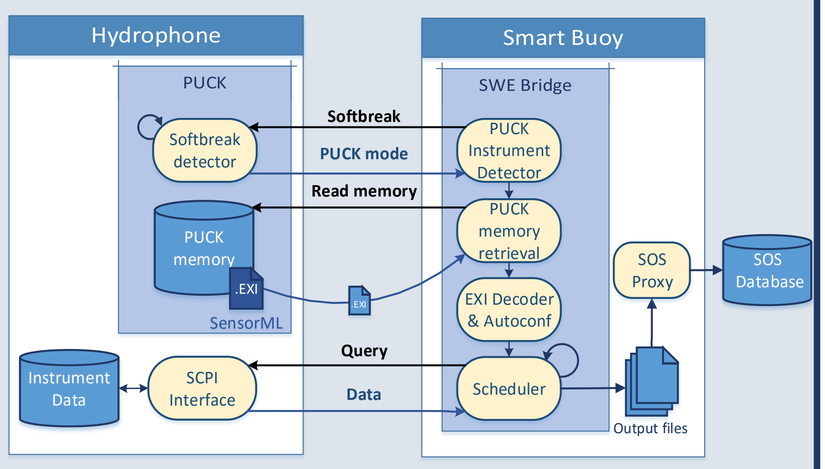

Figure 8. NeXOS A1 Hydrophone - Smart Buoy interoperability

Protocols & Standards

SensorML

The Sensor Model Language is an OGC standard for semantically-tied description of processes and components of measurement and acquisition systems into a single standardized XML file, containing identifiers, calibration parameters and communication interfaces among others.

PUCK Protocol

The **OGC Programmable Underwater Connector with Knowledge** protocol enhances interoperability, allowing automatic instrument discovery, instrument auto-description (electronic datasheet) and automatic retrieval of files stored within a non-volatile PUCK memory.

SOS

The **Sensor Observation Service** standard defines an interoperable way to manage observation data. This standard defines a Web service interface which allows querying observations, sensor metadata, as well as representations of observed features.

EXI

The **Efficient XML Interchange** (EXI) is a W3C format that enables the compression of large ASCII XML files into binary files, significantly reducing its size.

Acknowledgment

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