OGC Standards for End to End Sensor Network Integration

K. Headley 1
A. Broering 2
T. O'Reilly 1
D. Toma 3
J. del Rio 3
F. Bache 4
L. Bermudez 5
J. Zedlitz 6
G. Johnson 7
D. Edgington 1

1 MBARI
2 ITC University of Twente
3 UPC - SARTI
4 52North
5 OGC
6 Christian Albrechts University at Kiel
7 RBR Ltd

Many sensor networks have been deployed to monitor Earth's environment, and more are planned for the future. Environmental sensors have continuously improved by becoming smaller, cheaper, more intelligent, and more reliable. But due to the large number of sensor manufacturers and accompanying protocols, integrating diverse sensors into observing systems is not straightforward, requiring development of driver software and manual tedious configuration. Use of standard protocols and formats can improve and automate the process of sensor installation, operation, and data processing. The Open Geospatial Consortium's Sensor Web Enablement (SWE) initiative defines standards which make sensors available over the Web through standardized formats and Web Service interfaces by hiding the heterogeneity of sensor protocols from the application layer. Current SWE standards do not deal with actual sensor protocols, and the connection between sensors and SWE services is usually established by manually adapting the internals of the SWE service implementation to the specific sensor interface. Such sensor "drivers" have to be built for each kind of sensor interface, which leads to extensive efforts in developing large-scale systems.

To tackle this issue we have developed a model for Sensor Interface Descriptors (SID) which enables the declarative description of sensor interfaces, including the definition of the communication protocol, sensor commands, processing steps and metadata association. The model is designed as a profile and extension of OGC SWE's Sensor Model Language standard. In this model, a SID is defined in XML for each kind of sensor protocol. SID instances for particular sensor types can be reused in different scenarios and can be shared among user communities. A SID interpreter can be built which translates between various sensor protocols and SWE protocols, hence closing the described interoperability gap. The SID interpreter is

independent of any particular sensor technology, and can communicate with any sensor whose protocol can be described by a SID. The SID interpreter transfers retrieved sensor data to a Sensor Observation Service, and transforms tasks submitted to a Sensor Planning Service to actual sensor commands.

The proposed SWE PUCK protocol complements SID by providing a standard way to associate a sensor with a SID, thereby completely automating the sensor integration process. PUCK protocol is implemented in sensor firmware, and provides a means to retrieve a universally unique identifer, metadata and other information from the device itself through its communication interface. Thus the SID interpreter can retrieve a SID directly from the sensor through PUCK protocol. Alternatively the interpreter can retrieve the sensor's SID from an external source, based on the unique sensor ID provided by PUCK protocol.

In this presentation, we describe the end-to-end integration of several commercial oceanographic instruments into a sensor network using PUCK, SID and SWE services. We also present a user-friendly, graphical tool to generate SIDs and tools to visualize sensor data.