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An Alternative Sensor Description Mark-Up Language

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An ever-increasing amount of sensor assets are being exposed via the World-Wide Web. Discovery, selection and use of the huge number of observations these assets produce requires a robust sensor information model.

Several approaches to develop a robust sensor information model have been attempted. For example, the Open Geospatial Consortium (OGC) has developed standard information models to describe sensor observations (Observations and Measurements (O&M)) and sensor devices and procedures to generate observations (Sensor Modelling Language (SensorML)). SensorML was developed primarily to support the description of sensors on moving platforms (e.g. earth observation satellites and aircraft), where the main issue is computing the location of the sensed area on the ground. Though SensorML is very generic and provides a functional view of sensors, it can only be used through the Java library developed by its designers. SensorML is very flexible and allows sensors to be described in multiple ways. This creates interoperability problems at the encoding level. Another sensor information model is the Semantic Sensor Network Ontology (SSNO) developed by the W3C Semantic Sensor Network Incubator Group. The SSNO defines key elements of a sensor network. One feature of the SSNO is that it is rooted to core concepts in the Dolce Ultra-Light (DUL) upper ontology. The makes it hard to reconcile the SSNO with O&M, which follows a more conventional approach to describing how things are observed in the physical and natural sciences.

We have selected the best parts of both SensorML and the SSNO in an alternative sensor information model to overcome the limitations of each. Our alternative information model (referred to hereafter as the Starfish Fungus Language(*FL)) is designed to provide concise and user-friendly sensor descriptions that fully describe the procedures used to generate observations. Sensor descriptions are constrained by well-defined and strictly-applied semantic rules aligned to O&M.

At the core of *FL are the following four elements: Sensing, Sensor Characteristics, Deployed Sensing, Deployed Sensor. Sensing is a static description of a process, which derives a result from an observed property of a phenomenon. By combining it with other sub-procedures it is flexible enough to describe complex sensing procedures. The observation producing part and the interface to O&M are captured by Deployed Sensing. Deployed Sensing is a deployed element attached to a Deployed Sensor in the field and represents an executed Sensing procedure. Deployed Sensor stores information about the actual deployment and its requirements or the serial numbers of the devices. Sensor Characteristic aggregates Sensing elements and describes static characteristics that are the same for each sensor device model. Together, Deployed Sensor and Sensor Characteristics form the device description in *FL.

A key advantage of *FL is its modularity that allows sensor descriptions to be generated by different authorities. The two static elements Sensor Characteristics and Sensing are described by the manufacturer and reusable by multiple sensor deployments. Deployed Sensing and Deployed Sensor, on the other hand, are described on an operator level. In contrast to SSN and SensorML, *FL suits O&M and has stricter rules than SensorML. We are currently evaluating the applicability of *FL in several projects, where there is a need to address data quality, complex calibration scenarios, and frequent sensor redeployments. Future work includes testing *FL in more complex situations like moving sensor platforms.