SensorWeb 3.0 Software Release Notes

March 27, 2009, Melbourne, Australia

Introduction
The identification of common data operations and transformations on sensor data has fuelled the birth of the Sensor Web paradigm. Sensor Web combines sensors and sensor networks with a Service Orientated Architecture (SOA). A SOA allows us to discover, describe and invoke services from a heterogeneous software platform using XML and SOAP standards. When interlinked, geographically distributed services form what is called a Sensor Grid; this is a key step in the integration of sensor networks and the distributed computing platforms of SOA and Grid Computing. Services are defined for common operations including data query, retrieval and aggregation, resource scheduling, allocation and discovery. Sensor networks can be discovered, accessed and controlled over the World Wide Web.

Open Sensor Web Architecture and Middleware Capabilities
The Open Sensor Web Architecture Middleware is built upon a uniform set of operations and standard sensor data representations as defined by the Open Geospatial Consortium (OGC). The OGC is a geospatial standards authority that has defined a Sensor Web Enablement (SWE) method which includes specifications of interfaces, protocols and encodings that enable discovering, accessing, and obtaining sensor data as well as sensor processing services. The following are the five core specifications of the SWE which are implemented in our SensorWeb middleware as core services:

1. Sensor Model Language (SensorML) – Information model and XML encodings that describe either a single sensor or sensor platform in regards to discovery, query and control of sensors.
1. Observation and Measurement (O&M) – Information model and XML encodings or observations and measurement.
2. Sensor Collection Service (SCS) – Service to fetch observations, which conform to the O&M information model, from a single sensor or a collection of sensors. It is also used to describe the sensors and sensor platforms by utilizing SensorML.
3. Sensor Planning Service (SPS) – Service to help users build a feasible sensor collection plan and to schedule requests for sensors and sensor platforms.
4. Web Notification Service (WNS) – Service to manage client sessions and notify the client about the outcome of the requested service using various communication protocols.

One of the key challenges of our SensorWeb project is how to support ongoing sensor queries which persist over time to heterogeneous sensor networks. This challenge is addressed with the following features; (i) all services are implemented as stateful Web Services (WSRF), (ii) the SCS works with many different types of sensors, from TinyOS running on Mica2, MicaZ, Imote2 and Sunspot Sensors, (iii) services are capable of handling concurrent requests from multiple users, .

Software Release and Publications

The SensorWeb 1.0 was developed and released in 2005 (under GPL licence, libraries in LGPL) by the Grid Computing and Distributed Systems (GRIDS) Laboratory at the University of Melbourne. This work was further extended, during 2006-2007, as a NICTA (National ICT Australia) project to support heterogeneous sensors and state oriented Web services. SensorWeb 2.0, was released in June of 2008 under the GRIDS Laboratory. SensorWeb 3.0 is developed by members of GRIDS Lab (led by Dr. Buyya) and ISSNIP (led by Dr. Palaniswami) as part of their DIISR supported International Science Linkage Project on UtilityGrids. SensorWeb 3.0 is available for download under LGPL licence and the software and associated documentation can be downloaded from:
       http://www.gridbus.org/sensorweb

The release of OSWA 3.0 includes some major feature additions these are as follows:
1. Service interface upgrade and name change for the Sensor Collection Service (SCS) to the Sensor Observation Service (SOS), conforming to the latest OGC specification.
2. SOS support for SunSpot sensors
3. SOS Gesture recognition demo application using SunSpot sensors and service side machine learning module
4. Upgrade of Observations and Measurements (O&M) specification to latest OGC specification, compatibility of OSWA O&M data with Semantic SOS developed at the. Kno.e.sis Center at Wright State University.
5. Implementation of Submit() method for the Sensor Planning Service (SPS), including conformance to the latest OGC specification.
6. Introduction of novel caching methods in the SOS

The key contributors to the SensorWeb 3.0 middleware include:
- Rajkumar Buyya
- Tomasz Kobialka
- Peng Deng
- Marimuthu Palaniswami

Key publications related to SensorWeb 3.0 are:

- Tomasz Kobialka, Rajkumar Buyya, Peng Deng, Lars Kulik, Marimuthu Palaniswami, Sensor Web: Integration of Sensor Networks with Web and Cyber Infrastructure, Handbook of Research on Developments and Trends in Wireless

Sensor Networks: From Principle to Practice, IGI Global, USA, 2009. (in press, accepted on March 3, 2009).

Future Work Roadmap

 For the next version (SensorWeb 3.1) we are working towards the following innovations:

- Full Implementation of all SPS methods and conformance to OGC specification
- Visualization tool for demonstration SPS functionality

We anticipate that SensorWeb 3.0 will be released mid 2009.

The members working towards future advances in SensorWeb 3.0 include: Rajkumar Buyya (Director of GRIDS Lab), M. Palaniswani (Head of ISSNIP Group), Charity Laplap (PhD candidate) and Peng Deng (Programmer).

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