Demonstration: *Sensapp* — An Application Development Platform for OGC-based Sensor Services

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Abstract. This paper introduces the Sensapp platform, a semantic and OGC-based sensor application platform to enable users to register, annotate, search, visualize, and compose OGC-based sensors and services for creating added-value services and applications. Functionalities of Sensapp such as sensor registration, sensor data visualization, visual composition and generation of executable service compositions are presented through the demo.

Keywords: OGC services, service annotation, discovery, and composition, sensor Web application.

1 Introduction

With the dramatic increase of sensor devices, large scale management of real-time data from such devices has become a real issue. Abstracting, selecting, and presenting real-time sensor data to end-users and decision makers in a suitable manner is a key requirement for enabling better decision making when dealing with processes involving real-time sensor data. Moreover, the need for supporting application developers in making sense of the huge amounts of real-time sensor data and using the data for creation of added-value applications and services implies development of novel platforms enabling faster and smarter development of added-value services. *Sensapp* (short for "*Sens*or *ap*plication *p*latform") is being developed as a platform addressing such needs. Focusing on the use of open standards such as those developed by the Open Geospatial Consortium (OGC)[1] and World Wide Web Consortium (W3C),[2] Sensapp aims to deliver a semantic and OGC-based sensor Web application platform to enable users to register, search, visualize, and compose OGC-based sensors and services for creating added-value services and applications on the Web.

Figure 1 provides an overview of the platform and its main components. The major stakeholders/roles in a Sensapp environment are resource providers, app/service developers, and application consumers (typically decision makers). Resource providers provide different kinds of resources such as sensors and data and

1 http://www.opengeospatial.org/
2 http://www.w3.org/

processing services. Data formats and protocols for accessing such resources are usually proprietary. The app/service developer is the main stakeholder interacting directly with all Sensapp components. Through the registration facility, the app developer will package and provide the sensor, data, and processing services as standardized OGC interfaces (e.g., Sensor Observation Services (SOS) [1], Web Feature Services (WFS) [2], Web Processing Services (WPS) [3], Sensor Event Services (SES) [4], etc). These OGC service interfaces are then semantically annotated through the annotation functionality of the platform. The Resource Description Framework (RDF) [5] annotations are used in the discovery and composition components. The discovery functionality enables enhanced search for services, which in turn will be used in the composition process where new added-value services are created. Composition is done by the app developer in a visual manner, based on the Business Process Modeling Notation (BPMN) [6]. The composition component contains facilities for data mapping, where semantic annotations of services are used. Once a composition is created, an executable representation of the composition is generated in Web Service Business Process Execution Language (WS-BPEL) [7] and a service interface (typically in WSDL) is created for the newly developed service. Based on portlets technologies (in particular Java Portlet Specification [8]), the platform can generate graphical components (scenario websites) corresponding to the developed services. The end user (typically decision makers) can consume the added-value services through the generated scenario websites.

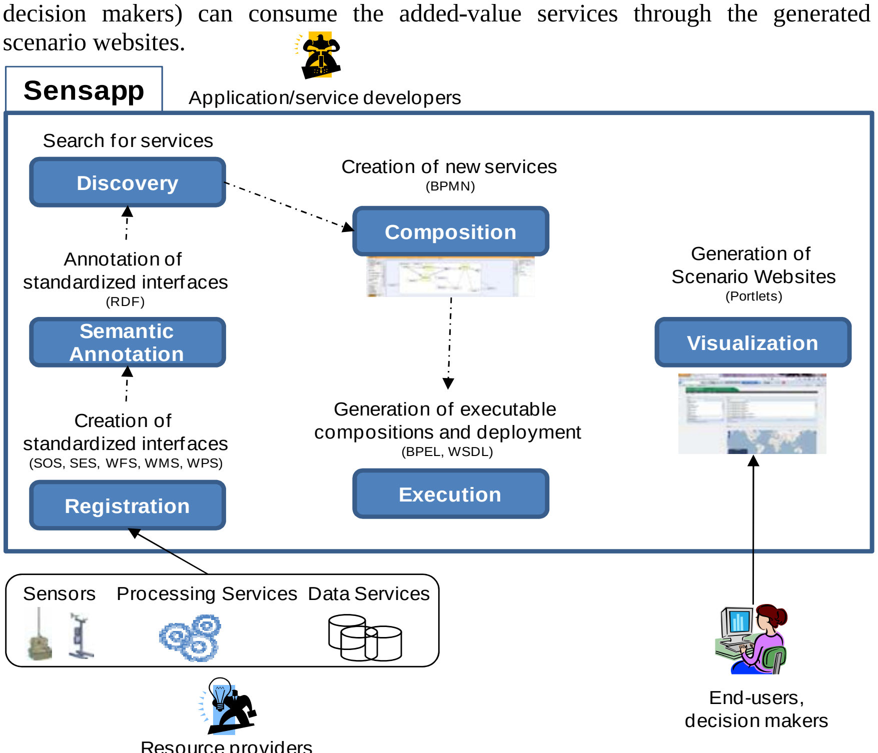

Fig. 1. Sensapp overview

By supporting abstraction of sensor data and services to standardized OGC interfaces/services, semantic annotation of such interfaces, enhanced discovery and composition of services, and data visualization on maps and charts, Sensapp aims to enable better access to sensor data and to create opportunities for faster and smarter development of added-value services based on real-time sensor data.

2 Demonstration

The demo will present some of the functionalities of Sensapp in particular related to sensor registration and visualization, visual composition and generation of executable compositions:

1. *Registration of OGC services*: Demonstrates how OGC services are registered to the Sensapp platform.
2. *Registration of individual sensors*: Demonstrates the registration steps for individual sensors, including editing configuration files and registration through a Web browser.
3. *Search for and listing of registered services and sensors*: Demonstrates the search and display functionalities for locating and listing services and individual sensors.
4. *Visualization of sensors locations on maps*: Demonstrates the map localization of registered sensors.
5. *Visualization of historical sensor data on charts*: Demonstrates the use of charts for visualizing historical observation data from individual sensors. The user can zoom in the chart and select a duration.
6. *Visualization of sensor event data on charts*: Demonstrates real-time visualization of events from individual sensors on charts.
7. *Composition of services*: Demonstrates the BPMN-based composition of registered SOS, WFS and WPS services.
8. *Data mediation*: Demonstrates how to specify data flow mapping for the composed SOS, WFS and WPS.
9. *Generation of WSDL and BPEL files for composed services:* Demonstrates the generation of WSDL and BPEL files for the composed BPMN model in the composition process.
10. *Publishing the composed model as a new resource*: Demonstrates the registration of the added-value service as a new resource in the platform, which can then be further used in compositions or for end-user applications.

3 Related Work, Summary, and Outlook

The huge amount of data generated by the increasing number of available sensor devices requires proper management in terms of abstraction, selection, and presentation in order to enable better decision making based on real-time sensor data.

Furthermore, development of added-value services based on such data needs to be faster and smarter. Sensapp aims to address these challenges by providing a sensor data/service management platform that combines open standards for abstracting interfaces from proprietary data and protocols, semantic technologies for better search and discovery, visual composition of services, and different data visualization techniques.

A working prototype of Sensapp with the functionalities presented in the demonstration section has been developed and is currently under performance evaluation. Some of the components such as the annotation, discovery, and execution components do not come with a graphical interface yet, but these are planned to be developed, possible with a close collaboration with the ENVISION project.[3] The source code of Sensapp is planned to be released as open source in the near future. As part of future work, the platform is planned to be deployed on the cloud and made available as a service for the wider community.

In enabling better access to real-time sensor data, Sensapp shares some of the ambitious of other initiatives such as HP Central Nervous System for the Earth (CeNSE) [9], Geospatial Cyberinfrastructure for Environmental Sensing (GeoCENS) [10], Nimbits [11], Pachube [12], Service Buss [13], or Hourglass [14]. Sensapp's focus on open standards as well as both on service developers and end-users, makes it a sensor integration platform that goes beyond the functionalities and scope of some of these approaches. Nevertheless, a detailed comparison with these existing approaches and possible synergies are part of future work.

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