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The Sensor Integration Platform TSB - current status and outlook

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The German Indonesian Tsunami Early Warning System (GITEWS) (Rudloff et al., 2006) is built upon a complex sensor system infrastructure providing seismological, near real time GPS deformation and tide gauge data via a sensor integration platform. The integration platform (called the Tsunami Service Bus TSB) implements the Sensor Web Enablement (SWE) standards and services following the paradigm of a Service Oriented Architecture (SOA).

The sensor systems and the TSB provide fundamental data for tsunami wave prediction. Development of the TSB recognized the fact of being able to incorporate a changing sensor system base with possibly proprietary data formats and delivering a stable and uniform interface to consuming clients, such as the Decision Support System at the warning centre. Thus, the TSB is architecturally divided into a *sensor*, *service* or *integration* and an *application* layer. Sensor integration features two distinct interfaces: a *Dispatcher* as a Java Message Service (JMS)-based receptacle for incoming data and a *Sensor Manager* for sensor tasking. The integration layer is comprised of the TSB providing the SWE service interfaces up to the application layer and the before-mentioned interfaces down to the sensor layer. Currently, an implemented sensor registry provides means of sensor metadata management for sensor location. The TSB features an implementation for a set of functional requirements, such as standard interfaces for processed sensor data provision and tasking, and a mid-term storage of incoming sensor data. Over the course of the GITEWS Project, the implementation of the TSB proved to be reliable and robust, operating 24/7 since 2009 at the BMKG tsunami warning center in Jakarta, Indonesia.

The TSB contains implementations for the SWE specifications of *Observations & Measurements*, *Sensor Model Language*, *Sensor Observation Service*, *Sensor Planning Service*, *Web Notification Service* and *Sensor Alert Service*. Functionality of the TSB (e. g. alert/ notify, task) required by application layer consumers is provided using the interoperable SWE services. Early case studies proved the general applicability of SWE for sensor based natural hazard systems (Walkowski, 2005; Moodley et al., 2006; Chu et al., 2006).

The TSB is logically clustered into five components, Processing, Provisioning, Tasking, Registry and Database reflecting the main functional use cases of a sensor integration platform. Data transportation is performed on basis of asynchronous message oriented middleware using JMS technology via JBoss Messaging. The TSB features reliable data transportation from received sensor data up to the application layer by means of JMS. A transactional processing workflow for every incoming message ensures that it is properly handled. New sensor types are integrated via a plug-in mechanism to incorporate specific semantics and data format. Provision of sensor data for the SWE services is realized through web service implementations. The TSB is easily deployed as a single Java EE enterprise application component (`*.ear`) within the JBoss application server.

Currently, the TSB is deployed on a JBoss 4.2.3-GA application server. Development is directed at elevating the TSB to be deployed onto the new JBoss 7.x application server, while also allowing a more flexible incorporation of new sensor system sources and sensor system types. This will allow reuse of the TSB in other projects, where reliable provision of sensor data by means of SWE interfaces is applicable. Furthermore, the TSB will be published open source as a sub project of the FOSSLAB community.