FACTSHEET
System Integration

GITEWS

German Indonesian Tsunami Early Warning System

Establishment of a Tsunami Early Warning System in the Indian Ocean – The German Contribution

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System Integration

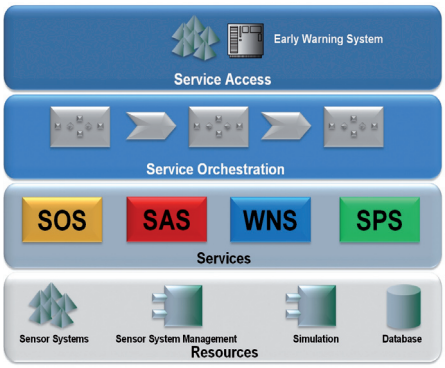
The German Indonesian Tsunami Early Warning System GITEWS is a complex system consisting of several sensor types like seismometers, sea level sensors, and GPS land stations, each sensor with its own system behavior and proprietary data structure. To operate a warning chain, beginning from sensor measurements scaling up to warning products, all system components have to interact in a correct way, syntactically and semantically.

Warning systems will evolve over time: New sensor types might be added, old sensors will be replaced and sensor integration as well as decision software will be improved. To keep GITEWS operating under these circumstances its software architecture must be tailored for evolution.

Given these requirements a flexible GITEWS infrastructure is a prerequisite for a successful and long living system integration. The working group *System Integration* is responsible for the underlying technical infrastructure for the warning centre in Indonesia.

Open Integration Platform

The technical infrastructure follows the blueprint of a *Service Oriented Architecture (SOA)*: From a collection of loosely coupled basic services more complex services could be composed to provide the functionality which is essential for a warning system. There are well known techniques to reduce the Impact of a service modification to its consumers allowing the evolution of GITEWS as a whole.



Designing service interfaces great emphasis was laid on conformity to the OpenGIS specification *Sensor Web Enablement (SWE) by Open Geospatial Consortium (OGC[1])*.

The benefits of using a flexible SOA architecture together with Sensor Web Enablement (SWE) as the interface standard leads to an open integration platform: Integrating, accessing, and controlling different types of sensors in a standardized and uniform way.

Sensor System Infrastructure

The sensor system infrastructure is realized on the basis of the J2EE -compliant industrial strength open source application server JBoss. It provides sensor data and enables interaction with sensors via the following four services:

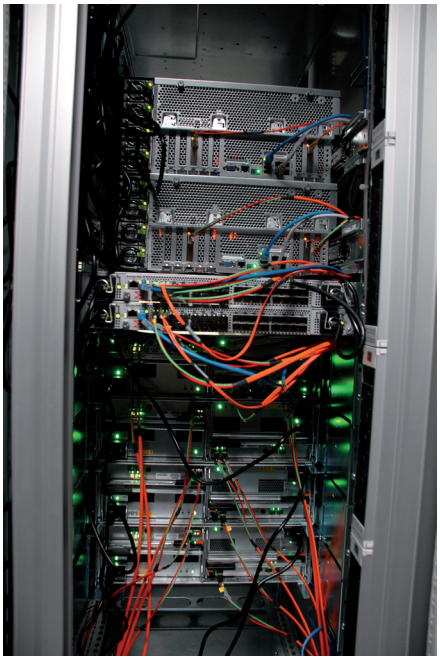
- A SWE-compliant Sensor Observation Service (SOS) to retrieve sensor observations and sensor capabilities.
- A Sensor Alert Service (SAS), which is functional equivalent to SWE, but uses Java Messaging in order to deliver sensor alerts.
- A SWE-compliant Sensor Planning Service (SPS) to activate or deac-

tivate special sensor features or to asynchronously start processing and sensor observations.
- A Notification Service, which is functional equivalent to a SWE Web Notification Service (WNS) but uses Java Messaging to provide notifications about sensor state changes and success of asynchronously executed processes.

For hardware the enterprise-class SUN X4600 and X4200 machines were chosen. Together with Linux operation systems and XEN virtualization these servers operate all systems in the warning centre.

System Integrity

The development of GITEWS is distributed over several workgroups located in Germany and Indonesia. To ensure the architectural and functional integrity during the development process technical supervision is provided by the *Fraunhofer Institute for Software and System Engineering (ISST[2])*.



Architecture and management reviews are continuously carried out to ensure the interface compliances between the work packages. Identified deviations are reported to the GITEWS project management. Technical assistance and expertise is provided for certain IT aspects: Assessments of architectural designs, evaluating of hardware and software, and design of redundancy strategies.

Special emphasis is laid on test activities as an integral part during the implementation phase. Assuring the quality of system and software tests are performed by *IABG[3]*. Testing in GITEWS is carried out on the basis of "real world" scenarios, simulating the sensor and system behavior under real conditions.

Communication Infrastructure

The communication infrastructure workgroup is responsible for data links in general, including data transmission from in situ sensors to the warning center as well as data exchange between GITEWS and its partner organizations and the LAN architecture of the warning centre itself.

Since public communication facilities are failure prone during natural disasters, much effort was taken to establish a network of satellite links providing a separate communication infrastructure independent on the insecure and unreliable Internet.

Special security precautions are required for GITEWS' network over distributed locations in Indonesia and Germany. The entire network is isolated by means of *Virtual Private Networks (VPN)* against the Internet and unauthorized access. Direct public access of any kind is in general prohibited. Necessary data access from and to external partner organizations is restricted to designated data exchange servers.

[1] www.opengeospatial.org
[2] www.isst.fhg.de
[3] www.iabg.de

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Further information:

http://www.gitews.org

Partners in Germany:

GFZ German Research Centre for Geoscience
German Aerospace Centre (DLR)
Fraunhofer Institute for Software and System Engineering (FHG ISST)
IABG (Industrieanlagen-Betriebs–gesellschaft mbH)

Indonesian and International Partners:

Meteorological and Geophysical Agency (BMG)
National Coordinating Agency for Surveys and Mapping (BAKOSURTANAL)
Agency for the Assessment and Application of Technology (BPPT)