Development of Integration Framework for Sensor Network and Satellite Image based on OGC Web Services

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With the availability of network enabled sensing devices, the volume of information being collected by networked sensors has increased dramatically in recent years. Over 100 physical, chemical and biological properties can be sensed using in-situ or remote sensing technology. A collection of these sensor nodes forms a sensor network, which is easily deployable to provide a high degree of visibility into real-world physical processes as events unfold. The sensor observation network could allow gathering of diverse types of data at greater spatial and temporal resolution, through the use of wired or wireless network infrastructure, thus real-time or near-real time data from sensor observation network allow researchers and decision-makers to respond speedily to events.

However, in the case of environmental monitoring, only a capability to acquire in-situ data periodically is not sufficient but also the management and proper utilization of data also need to be careful consideration. It requires the implementation of database and IT solutions that are robust, scalable and able to interoperate between difference and distributed stakeholders to provide lucid, timely and accurate update to researchers, planners and citizens.

The GEO (Global Earth Observation) Grid is primarily aiming at providing an e-Science infrastructure for the earth science community. The GEO Grid is designed to integrate various kinds of data related to the earth observation using the grid technology, which is developed for sharing data, storage, and computational powers of high performance computing, and is accessible as a set of services. A comprehensive web-based system for integrating field sensor and data satellite image based on various open standards of OGC (Open Geospatial Consortium) specifications has been developed. Web Processing Service (WPS), which is most likely the future direction of Web-GIS, performs the computation of spatial data from distributed data sources and returns the outcome in a standard format. The interoperability capabilities and Service Oriented Architecture (SOA) of web services allow incorporating between sensor network measurement available from Sensor Observation Service (SOS) and satellite remote sensing data from Web Mapping Service (WMS) as distributed data sources for WPS.

Various applications have been developed to demonstrate the efficacy of integrating heterogeneous data source. For example, the validation of the MODIS aerosol products (MOD08_D3, the Level-3 MODIS Atmosphere Daily Global Product) by ground-based measurements using the sunphotometer (skyradiometer, Prede POM-02) installed at Phenological Eyes Network (PEN) sites in Japan. Furthermore, the web-based framework system for studying a relationship between calculated Vegetation Index from MODIS satellite image surface reflectance (MOD09GA, the Surface Reflectance Daily L2G Global 1km and 500m Product) and Gross Primary Production (GPP) field measurement at flux tower site in Thailand and Japan has been also developed. The success of both applications will contribute to maximize data utilization and improve accuracy of information by validate MODIS satellite products using high degree of accuracy and temporal measurement of field measurement data.