Environmental data on demand – enabling dynamic live data flows with Sensor Observations Services

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Over the last years the demand of near real-time environmental data has been steadily increasing. Consequently, systems for sharing such data are becoming more and more important.

Since 2006, the European Environment Agency (EEA) has been operating “Ozone web” based on in-situ ozone measurements delivered in near real-time by the EU member states. This system is built on proprietary data formats using technology from Microsoft and ESRI. Recently the data flow has been expanded to also cover other air quality components like PM10, NOx etc., but also bathing water quality samples during the summer are being served through the platform and next to come will be noise data. As of October 2011 EEA is receiving data from 70 data providers, divided on 34 European countries. However, the use of proprietary data formats has some serious drawbacks:

* Development and maintenance costs are high, for EEA as well as for collaborating entities; these costs increase with every additional protocol that has to be supported.
* The data exchange systems have a tendency to become closed systems, making integration with enterprise solutions difficult.
* To share and use data in external applications specific software needs to be developed and maintained for each scenario.
* Application specific software can usually not be reused, i.e. different solutions are built to support different thematic domains (airquality, bathingwater quality, noise)

Consequently EEA sees a significant need to rely on open standards and a service based architecture for exchanging environmental data within Europe and in particular between EEA and the EU member states. This will on the one hand facilitate the access to environmental data provided by the EEA and on the other hand reduce the workload for collecting data from the different member states.

A technology able to fulfil these needs is the Sensor Web Enablement (SWE) framework of the Open Geospatial Consortium (OGC). SWE comprises a set of specifications of data formats for sensor data and metadata as well as web service interfaces (e.g. for accessing sensor data). Among the SWE standards especially the Sensor Observation Service (SOS) interface and the Observations and Measurements (O&M) data format have already reached a broad acceptance. Whereas the SOS offers an interface for retrieving sensor data and metadata, O&M provides a common encoding for data measured by sensors. Several pilot projects have successfully evaluated the practical application of SWE, among them several EU funded FP6 and FP7 projects (e.g. SANY, http://www.sany-ip.eu; OSIRIS, http://www.osiris-fp6.eu; GENESIS, http://genesis-fp7.eu/). In recent years, these positive results have led to several SWE based systems that have been deployed for productive use. Examples include the German Indonesian Tsunami Early Warning System (http://www.gitews.de) or the PEGELONLINE-SOS providing near-real time water level data for all federal waterways in Germany (http://www.pegelonline.wsv.de/webservices/gis/sos).

An example of usage is Eye on Earth, with the aim of making environmental data and messages available to the public. One part of Eye on Earth is Airwatch which receives near real-time monitoring data (Ozone, PM10, NO2) on an hourly basis from the EU member states. The data sets are provided by the member states to the EEA using a proprietary data format and exchanged to Airwatch through another proprietary XML format. A similar situation is the case for Waterwatch, which provides bathing water quality information, only is the frequency of new data maximum twice a month during the bathing water season, and only for a limited number of countries. Moving to a SWE based architecture the data exchange between the EEA and EU member states would be based on SOS and O&M, and instead of developing and maintaining proprietary software and data exchange formats, Eye One Earth would simply request data from a standards compliant SOS server and hereby get exactly the data sets needed.

Another example concerns the provision of data by the EEA. For research and modelling a number of organisations and research institutes receives airquality data from EEA on a hourly basis. Currently there are two possibilities; either you can get the data as raw xml files, which unfortunately give the receiver a considered amount of data processing. Alternatively EEA provides a data extraction service where it is possible to specify a time extent and the component (O3, NO2, etc.) of interest. The next step will be to SOS enable the platform and hereby providing a very flexible solution which we expect the GIS industry to support.