

Integration and Visualization of dynamic Sensor Data into 3D Spatial Data Infrastructures in a standardized way

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Integrating actual sensor data, such as weather or environmental information can improve the value of Geographical Information Systems (GIS) enormously. These applications are nowadays supported by Spatial Data Infrastructures (SDI) in order to find, access and utilize relevant geodata. In contrast to the mostly static data in conventional Spatial Data Infrastructures (e.g. administrative boundaries) by now, sensor information need new standards to realize the integration of this dynamic data into SDI. These new challenge was handled by the Open Geospatial Consortium (OGC) within its Sensor Web Enablement (SWE) initiative. Several standards to administrate, detect and receive sensor data were passed, for example a Sensor Observation Service (SOS). For validating the standards of the SWE there are already existing applications using sensor information that is provided by a SOS. But those cases are predominantly designed for 2D data. This paper demonstrates an approach to integrate sensor information into a 3D-client of a 3D-SDI completely based on the standards of the Open Geospatial Consortium. This leads to the new concept of dynamic 3D SDIs. An according prototype has already been implemented and will be presented.

The 3D-client mentioned above in which the sensor data can be integrated is the XNavigator software developed in the project www.GDI-3D.de. This application allows the visualization of 3D city and landscape models provided by an OGC Web 3D Service (W3DS) and the interactive navigation through the scene. In order to visualize actual sensor data served from a SOS, the XNavigator has been extended by a plug-in. This plug-in is so designed that it can query a known SOS by its URL so as to display the included sensors from the SOS with their current sensor values in a shortlist. By user-interaction the sensors can be loaded into the 3D-scene so they are shown by a 3D-symbol at their real world position.

By the use of this open architecture of the OGC Sensor Web Enablement it is possible to handle nearly all types of sensors. To validate the concept of the integration of sensor data into the 3D-client an internal SOS has been set up with several sensor types, such as gauge indicators, thermometers, smoke detectors or door locks. This variety of sensors intimates that there are many fields of application for 3D sensor information. On the one hand such a system can be used as an open sensor information terminal for the wider public. Opposed to similar proprietary systems like Google Earth, this approach is based on the open OGC standards. Therefore it is very flexible and adaptive. Other cases for utilizing this 3D-sensor-client are special applications such as decision support systems for disaster management or sensor monitoring systems, for example in facility management. Even an indoor use case has already been tested with the developed prototype. This is also relevant for the current

OGC OWS-6 testbed, where an indoor disaster management use case including sensors and 3D visualizations will be tested.

Future investigations shall offer a concept to analyze and geoprocess the sensor information by the standardized OGC Web Processing Service (WPS) interface. A possible process could be an interpolation of point observations to areas or even surfaces. These would be represented as 3D-polygons, which could be stored in a standardized way and offered by a W3DS in order to provide them for usage. The interpolation of the sensor values over a certain region could be the base for more advanced simulation models. These possibilities and resulting visualization options will be discussed in the full paper.

The application can be tested online at www.gdi-3d.de

The following screenshots show live sensor data from the SOS in a 3D-scene received from the Web 3D Service.



