University of Salzburg
Department of Computer Sciences
Planned Master's Thesis

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Title: SCADA2GIS Implementation - Bridging Industrial Automation Measurements and Geographic Information Systems Data in Near-Real-Time Using Open Standards

In this thesis, I address the research topic, the development and implementation process of bridging/transferring information between two distinctive domains (SCADA and GIS). Finally I present a fully functional prototype software implementation for interchanging near-real-time information. SCADA (Supervisory Control and Data Acquisition) is used to control automated industrial machines and processes in plants and factories. The SCADA domain will be represented through Zenon - an industrial automation software for process visualization and control - and OPC UA - an interoperability standard with unified architecture for industrial automation & related domains.
GIS (Geographic Information Systems) deals with the representation, manipulation and analysis of geographically referenced information. In this thesis, I focus on a specific part of GIS, in particular the standardized integration of near-real-time measurements implemented with the OGC (Open Geospatial Consortium) SOS (Sensor Observation Service) standard. The SOS standard describes standardized methods how to overcome interoperability obstacles between heterogenous sensor webs and enables an interchange of sensor data in an interoperable way.

Since sharing information between SCADA and GIS should not be limited to one specific use case scenario, my development will target a simulated SCADA environment. It's structure is based on real world projects, but the various sensor measurement values will be simulated. The main goal of this project is to provide a prototype system architecture that dynamically allows the interchange of heterogenous data from both very distinctive domains. This will improve complex event processing, lead to a better understanding of evolving situations and finally support decision making processes. Security is obviously an important issue. Therefore, automated data interchange is enabled, but the requestor has to process and integrate the received data into his own system explicitly.

The resulting full stack of combined methods and technologies could be applied to various real world use case scenarios:

- Hydroelectric power plants / dams could be automatically alerted if a specific amount of rainfall has occurred in a specific area
- A hiking route planning application could access the free open sensors of a hydroelectric power plant to provide information about gauge height, water- and air temperature, ...

- A KNX controlled house could access precipitation or wind sensors and e.g close skylight windows, window blinds or activate the sprinkler installation

In the first few chapters I provide an overview of SCADA and GIS - with a focus on OPC UA, Zenon and SOS respectively. The existing problems, the paramount importance of data interchange and the resulting advantages are analysed. In the following chapters I describe my approach of implementing a software solution as a bridge between SCADA systems and GIS in near-real-time using open standards. In order to retrieve dynamic data from a SCADA system I will develop a complete ready to use GUI application based on OPC UA. The cornerstones of the following data distribution are the integration of an event-driven model, GeoEvent server, web sockets with PUSH, data interchange with XML/JSON and a SOS web service.