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Effective metadata management of sensor networks using semantic wiki technology

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In recent years, sensor networks have gained wide popularity and have become more sophisticated and heterogeneous. Effective metadata management plays a crucial role in processing and properly interpreting the sensor measurement data from these networks. In many sensor networks, metadata of sensors and processing steps are still managed very isolated. For effective metadata management of sensor networks there is the need to manage metadata in a collaborative fashion. It requires for the metadata system that all individual metadata sources can be combined or linked to generate provenance metadata for all observations from the network. To perform these tasks efficiently, the metadata system needs user friendly abilities to add, maintain and gather sensor metadata as well as semantics behind processing steps for understanding data processing workflows. In addition, services for querying, viewing, importing and exporting metadata are needed as well as services to notify about metadata changes and the ability to add remarks that may explain anomalies in the data.

Given these requirements, the characteristics of semantic wiki technology makes it ideal for use in a collaborative metadata management system. A wiki is a web-base system for collaborative creation and change of web pages (e.g. information articles) and a semantic wiki provides in addition the ability to easily annotate these web pages using semantics that provide references to uniquely identified entities (e.g. typed links to pages or data). In fact, semantic annotations enable modelling of any process by meaningfully annotating the entities hence connecting them semantically. Furthermore, semantic wiki provides a method to ensure consistency of content and powerful techniques to find, compare and reuse information.

At KNMI, metadata of observations from the KNMI sensor network is stored in several information systems that are only loosely linked. The collection of provenance metadata by scientists is therefore time-consuming and poses a risk to correct interpretation of observations. Also engineers and inspectors maintaining the network need to access many systems for information and have to keep the (duplicated) information consistent. This can be laborious and poses a risk to data integrity of sensor network information. To provide better access to metadata for provenance of observations and to manage this metadata more effectively, the need for a collaborative metadata management system has been expressed. To meet this need, a project has been started and performed a pilot to investigate the ability to use Semantic Mediawiki (SWM) as collaborative metadata management system at KNMI. SMW is a popular open-source semantic wiki and has a large user community. It provides functionality to annotate information with semantics (including RDF triplets) and functionality to perform semantic queries (including SPARQL support). Furthermore, many SMW extensions are available to represent query results and to import and export semantics and articles.

At the EGU conference, I will present the results of a SMW pilot to achieve effective metadata management in a collaborative fashion for a sensor network at KNMI.