Semantic WISE: An Applying of Semantic IoT Platform for Weather Information Service Engine

Junwook Lee[a], Youngwoo Kim[a], Soonhyun Kwon[b,*]
[a]Platform Research Division, Handysoft Inc., Korea
[b]Electronics and Telecommunications Research Institute, Daejeon, Korea

***Abstract*— In this paper, we present the application case of semantic IoT platform technology to WISE project in Korea Meteorological Services. Current M2M platform technology applied to weather service is mainly focused on remote data collection. Therefore, it is difficult to analyze the domain context for decision support and provide the better customized semantic related weather information. In WISE project, big data such as high-resolution weather data and model data are collected. Moreover, it aims to support the interoperability and convergence of IoT data for urban and rural meteorology services.**

I. INTRODUCTION

With the development of new communication technology and sensor technology, various attempts for supporting human life more conveniently are increasing. M2M technology is focused on the remote sensing and transport information to another machine via cellar network. Weather information service based on M2M technology is limited to a simple data acquisition and processing and is insufficient to provide a data integration and interoperability. On the other hand, more recent research on IoT(Internet of Things) technology[1] is trying to allow things to judge and operate autonomously and collaboratively by working through the Internet between things.

Recently, the attempts for applying semantic web technology to decision support M2M/IoT services are increasing. E.g. the SemSorGrid4Env project of EC[2] and Australian Climate Observations Reference Network - Surface Air Temperature (ACORN-SAT) dataset[3]. Unlike conventional meteorological services, semantic weather information service combined semantic web technology should be able to solve the data interoperability of diverse weather data and application domain data. However, due to the diverse and heterogeneous nature of IoT data, it is difficult to analyze user's context and better customized weather related semantic information. Current M2M platform technology applied to weather service is mainly focused on remote data collection. Therefore, it is difficult to analyze the domain context for decision support and provide the better customized semantic related weather information. As shown in Figure 1, in WISE project, big data such as high-resolution weather data and model data are collected. Moreover, it aims to support the interoperability and convergence of IoT data for urban and rural meteorology services.

In this paper, we present the application case of semantic IoT platform technology to WISE project in Korea Meteorological Services. More in detail, the platform architecture and developed semantic technology is described.

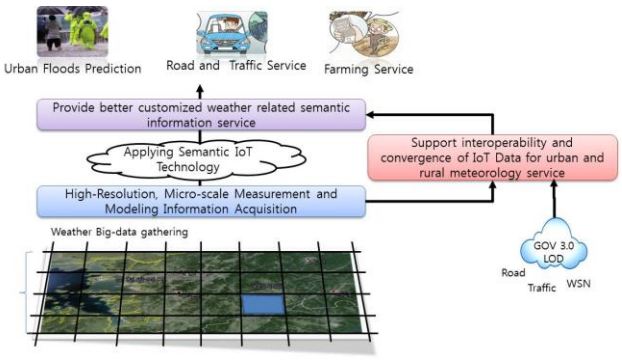

Figure 1. Overview of Semantic IoT technology for WISE platform

II. WISE PLATFORM

WISE[4], which is a recently launched project of the Korea Meteorological Administration (KMA) aimed at developing a next-generation Weather Information Service Engine (WISE). WISE represents an investment over eight years for efforts to resolve urban environmental issues, through scientific advances in high-resolution weather forecasting, urban flood prediction, road meteorology and urban carbon dynamics, and new urban service systems to minimize and mitigate the impacts of natural disasters and climate change on urban dwellers. The main objectives of WISE platform are the improvements of technology & infrastructure for the implementation of urban & rural meteorology information services, decision support for disaster relief, information production support for national agenda, and building up a mashup service platform for easy customized services.

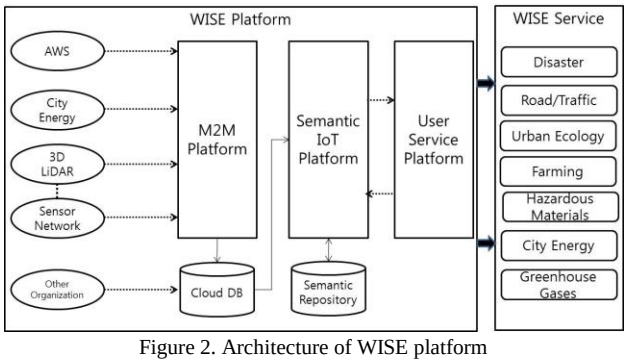

Figure 2. Architecture of WISE platform

As shown in Figure 2, WISE Platform consists of three sub-systems such as M2M platform, Semantic IoT platform and user service platform. Using M2M platform, diverse source of high-resolution weather data should be collected remotely and

stably. Realtime M2M data and legacy weather information are stored in cloud DB which provides scalability and high-performance. Big data from cloud DB can be translated into new semantic knowledge by integrating with domain data and LODs. Semantic IoT platform provide semantic annotation and semantic processing. The translated semantic data, which is RDF base data, is managed into semantic repository. Using the semantic open API of semantic IoT platform, various user portal services are supported by the user service platform.

III. WISE SEMANTIC IOT PLATFORM

The semantic IoT platform consists of five main modules as Figure 3: semantic ontology, semantic processor, semantic query engine, semantic repository and semantic open API.

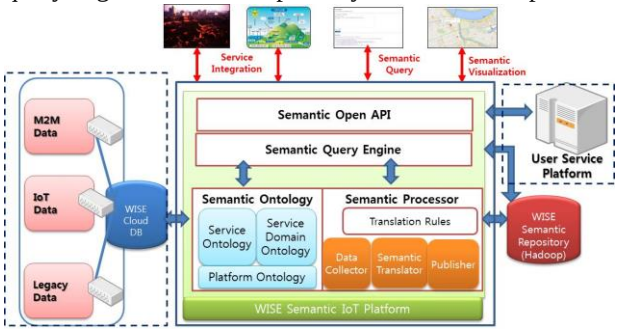

Figure 3. Overview of Semantic IoT Platform Architecture

A. WISE Platform Ontology

Several kinds of ontologies are defined to support the WISE semantic service: platform ontologies, service domain ontologies and service ontologies. Platform ontologies mean the commonly applied ontologies that are independent with specific WISE service. Figure 4 show the relationships of WISE ontologies.

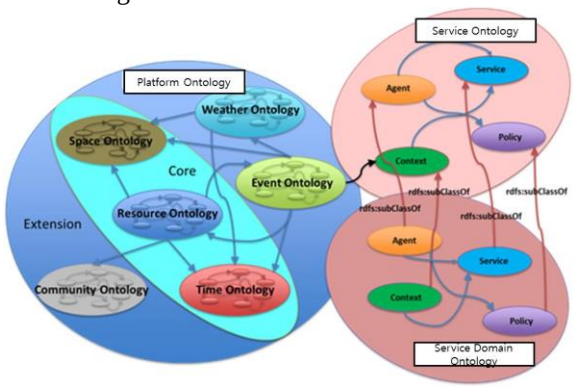

Figure 4. Relationship of WISE Ontologies

Therefore, platform ontologies generate description and process information to derive the abstracted real world event from sensing.

TABLE I PLATFORM ONTOLOGY INPUT/OUTPUT DATA

Type	Description
INPUT	- RDF based sensing data - Resource sub-ontology instance value
OUTPUT	- Abstracted realtime event - Processed event ontology instance value

B. Semantic Processing

The semantic processor performs the sensing data translation by using the translation rules and WISE ontology model. The semantic translator is a processor for converting non-semantic data(non RDF data) to semantic data(RDF data). The translation rules define the method of mapping each elements of the RDF triple pattern into the target ontology model or the value and type of the literal.

The translated RDF data are stored into semantic repository. To support scalability and performance of inference, semantic repository is implemented by using Hbase of Hadoop platform. Due to the nature of distributed and parallel processing of Hbase, our repository shows more high performance than any other existing RDF repositories.

C. Semantic Queries and Open API

The platform provides semantic query interface of SPARQL. The WISE applications or user service platform can query to derive more abstracted knowledge from semantic repository. In order to use the semantic platform easily, semantic query browser /visualization tool are required as shown in Figure 5.

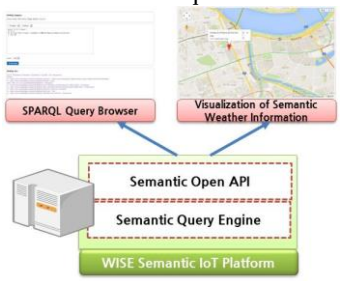

Figure 5. Semantic Service Development Support

IV. IMPLEMENTATION AND CONCLUSION

The implemented semantic IoT platform was applied to WISE project to generate semantic weather data and to provide better customized semantic related weather service. Based on the semantic platform, disaster management service was improved the functionalities of user context detection and prediction.

ACKNOWLEDGEMENTS

This work was supported by the project "Integrated Weather Services for Urban and Rural Area" of CATER.

REFERENCES

[1] Luigi Atzori, Antonio Iera, Giacomo Morabito, "*The Internet of Things: A survey*," Computer Networks, vol.54, pp.2787-2805, June, 2010.

[2] European Commission project SemSorGrid4Env (FP7-223913). http://www.semsorgrid4env.eu

[3] BOM. Australian Climate Observations Reference Network - Surface Air Temperature (ACORN-SAT). http://www.bom.gov.au/climate/change/acorn-sat/, 2012.

[4] Choi, Youngjean, and et al, A Next-Generation Weather Information Service Engine (WISE) Customized for Urban and Surrounding Rural Areas. Bull. Amer. Meteor. Soc., 94, ES114–ES117, 2013