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RESTful Sensor Web Enablement Services for Wireless Sensor Networks

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***Abstract*—Due to the large number of sensor manufacturers and differing accompanying protocols, integrating diverse sensors into observation systems is not straightforward. A coherent infrastructure is needed to treat sensors in an interoperable, platform-independent and uniform way. The concept of the Sensor Web reflects such a kind of infrastructure for automatically discovering and accessing appropriate information from heterogeneous sensor devices over the Internet. In this context, the Open Geospatial Consortium (OGC) established the Sensor Web Enablement (SWE) initiative that specifies standard interfaces and encodings to remotely access, encode and exchange the sensed data. However, SWE standards have several gaps that limitate its capabilities to achieve the sensor Web desires. In this paper, we address the problems related to the data format and the architectural style followed by the implementation of the SWE services. Indeed, we propose the adoption of the lightweight Representational State Transfer (REST) web services concept and the usage of JavaScript Object Notation (JSON) format as an alternative to the verbose XML one for the exchanged messages.**

***Keywords*-Sensor Web, Wireless Sensor Networks, Sensor Web Enablement, Representational State Transfer**

I. Introduction

Today, the notion of the sensor web has been largely influenced by the concept of the Internet-Of-Things. It is considered as an infrastructure that enables to collect, model, store, retrieve, share, manipulate, analyze and visualize sensor data/metadata via the World Wide Web (WWW) in a standardized way. Moreover, it acts as an extensive monitoring and sensing system that provides timely and continuous observations. Thus, *the Sensor Web is to sensor resources what the WWW is to general information sources, an infrastructure allowing users to easily share their sensor resources in a well-defined way* [1]. This new earth-observation system opens up a new horizon road to fast assimilation of data from heterogeneous sensors and to provide new knowledge that affects new decisions in the future.

A key challenge in building the Sensor Web is how to automatically access and integrate different types of spatiotemporal data that is observed by heterogeneous sensor devices or generated using simulation models. Another challenge issued by the fact that most applications are still integrating sensor resources through suitable mechanisms, instead of building upon a well-defined and established integration layer.

On the other hand, the sensor networks are currently developed around different communities of sensor and user types, each community typically relying on its own system, metadata semantics, data format and software. Thus, integrating diverse sensors into observation systems is not straightforward. It is typically hindered by incompatible services and encodings which can cause interoperability between different sensor nodes within the same WSN. This issue has been the driving force for the Open Geospatial Consortium (OGC) [1] to start the Sensor Web Enablement (SWE) initiative [2] whose architecture was designed to enable the creation of web-accessible sensor assets through common interfaces and encodings.

Although this intiative allows for fusing multiple data models and formats into a common data model and representation, it has the limitation that it only provides rudimentary support for the required data conversion. In addition, its framework presents some major gaps when it comes to data format and messages exchange, which are XML based. In fact, this format is verbose and therefore is not suitable for low power and data rate devices.

Apart from the data format, the architectural style followed by the implementation of the SWE services can generate serious problems. Indeed, There are several ways to realize the web service concept: some realizations are built on mechanisms that require significant processing power and communication bandwidth, whereas others are more lightweight. The resource constraints inherent in sensors regarding processing power, energy, and communication bandwidth necessitate the use of lightweight mechanisms.

To address these two challenges, we propose a lightweight RESTful approach based on SWE services for interacting with the constrained WSNs. Our proposed approach is based mainly on considering each sensor node as RESTful resources [2] that can be accessed and polled over the SWE services using the lightwight JavaScript Object Notation (JSON) data format as an alternative to the verbose XML

[1] http://www.opengeospatial.org/.
[2] http://www.ogcnetwork.net/swe.

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