Sensors-as-a-Service: Towards the Conceptualization of Sensor-Cloud

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This work focuses on the design and implementation of a holistic prototype of sensor-cloud infrastructure for realizing *Sensors-as-a-Service* (*Se-aaS*). Because of the limitations of conventional Wireless Sensor Networks (WSNs), the common mass of people cannot afford to use WSNs. To resolve this problem, the research focuses on the complete conceptualization and implementation of sensor-cloud – a cloud-based platform that is based on virtualization of physical sensors into Se-aaS.

INTRODUCTION

Contemporary Wireless Sensor Networks (WSNs) comprise of expensive sensors that are designed in proprietary, vendor-specific manner. The applications are mostly single-user centric and the end-users have to procure, maintain, and manage the network throughout its lifetime. Also, only user-organizations that own a sensor network have satisfactory access to sensor data. Recent research has conceived sensor-cloud architecture as a potential solution for traditional WSNs [1]. Although existing works have primarily focused on the principles, the dogma, and the challenges involved in this shift of paradigm, there lacks practical implementation works that can support the performance evaluation and analysis of sensor-cloud based systems.

The proposed research focuses on the design and development of sensor-cloud infrastructure that enables end-users to envision the conventional sensor nodes as a simple obtainable service (just like water or electricity), termed as *Sensors-as-a-Service* (*Se-aaS*) [2]. From an implementation point of view, the primary research challenge was to design the architecture of sensor-cloud and to address the intrinsic problems of sensor virtualization, sensor data optimization and management thereby eventually building a functional prototype. Hence, the research eventually focuses to design and build a fully-functional prototype of sensor-cloud and analyzes the suitability of this new platform. The novelty of this research is to proliferate the usability of sensor networks to the common mass of people (by shifting the paradigm to sensor-cloud platforms) merely as an easily accessible service. With this evolutionary concept, multiple user-organizations can access WSNs and execute their own applications over it without actually owning the sensor nodes or deploying a private WSN.

The proposed prototype of sensor-cloud thrives on the principle of virtualization of physical sensor nodes. It manages "big" unstructured heterogeneous (in terms of sensor hardware, vendor, and design) sensor data from varied data sources and arranges, correlates, and connects the data thereby, enabling the user organizations to execute the computationally intensive queries over large data sets in less time. From the requests of the user-organizations, the physical sensor nodes are dynamically consorted to form virtual sensor groups, as per requirements. On behalf of each virtual group, the aggregated data is transmitted to the end-user organization. Such infrastructure permits the execution of multiple applications within the sensor nodes, thereby dispensing services independent of location, application, and end-users. As an evaluation of sensor-cloud, an analysis is made based on the network performance and the cost-effectiveness of sensor-cloud by examining the cash inflow and outflow characteristics for every actor of sensor-cloud. Analytical results show that the sensor-cloud outperforms traditional WSN by increasing the sensor lifetime by 3.25% and decreasing the energy consumption by 36.68%.

REFERENCES

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