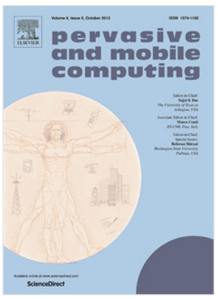
Accepted Manuscript



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PII: S1574-1192(17)30354-1
DOI: http://dx.doi.org/10.1016/j.pmcj.2017.07.002
Reference: PMCJ 868

To appear in: *Pervasive and Mobile Computing*

Received date : 30 May 2016
Revised date : 28 June 2017
Accepted date : 7 July 2017

Please cite this article as: B. Xiao, R. Rahmani, Y. Li, T. Kanter, Edge-based interoperable service-driven information distribution for intelligent pervasive services, *Pervasive and Mobile Computing* (2017), http://dx.doi.org/10.1016/j.pmcj.2017.07.002

Edge-based Interoperable Service-driven Information Distribution for Intelligent Pervasive Services

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Abstract

Internet of Things (IoT)-based Intelligent Pervasive Service (IPS) systems face increasing pressure from the massive amounts of heterogeneous data generated; the heterogeneity hinders interoperability between data resources and IPSs, making data sharing inefficient and making it difficult to satisfy the needs and fulfill requirements of the IPSs. In response, this article proposes a method of interoperable service-driven information distribution on the edge side to enhance the service-level interoperability with feature-level interoperability by self-adapting data sharing according to the service needs, which will also help to release incremental data pressure and provide better data privacy by conducting service-driven and relevance-based data sharing.

Keywords Pervasive Sensing; Interoperability; Service-driven; IoT Edge-centric; Self-adaptable information distribution.

1 Introduction

The Internet of things (IoT) should not be treated as just a network formed by physical devices with data transmission based on physical connectivity. Instead, the IoT consists of (and relies on) heterogeneous objects with both physical presence (e.g., sensors, mobile phones, appliances) and virtual presence (e.g., software agents and web objects), which can be generalized as *entities* [1]; these heterogeneous entities mutually share and exchange data for supporting Internet of Things (IoT)-based intelligent pervasive services (IPSs), either by capturing data from the surroundings or generating data themselves. A massive amount of heterogeneous entities creates an ocean of high-dimensional heterogeneous data [2][3]. The heterogeneity and large volume of data largely challenge the IoT system, especially when the IoT lacks sufficient understanding regarding the relations between IPS and data resources[4], which specifically do not know enough about how the data can be utilized to make the informative contribution to the IPS. Heterogeneity is very hard to eliminate, which should be handled by enhancing the system interoperability. Specifically, to obtain the necessary information from those heterogeneous big data, it becomes necessary to enhance the interoperability of the IoT between data resources and IPSs, by which the data are properly pruned, processed, and provided [3] to satisfy the needs of IPSs with fulfilling certain requirements.

The interoperability for the IoT data supply can be described in different levels, which are *data-level interoperability, knowledge-level interoperability, service-level interoperability,* and *feature-level interoperability.* As basic interoperability, data-level interoperability indicates that the data objects exchanged/shared between heterogeneous entities (or entity modules) are meaningful, understandable, annotatable, and can be comprehended by the entities during the exchanging/sharing process. Data-level interoperability enables data objects to be shared in a machine-understandable way. Data-level interoperability lays the basis for knowledge-level interoperability. Knowledge-level interoperability indicates that different entities (or entity modules) have common shared understanding of data objects based on coordinated interactions between entities (or entity modules). Knowledge-level interoperability enables heterogeneous data objects to be comprehended based on mutual common understanding between coordinated entities (or entity modules). Knowledge-level interoperability lays the basis for service-level interoperability, which indicates that the entity (or entity modules) can understand and have common shared mutual expectations regarding the actions of each other in responding to IPSs' needs. Service-level interoperability enables entities (or entity