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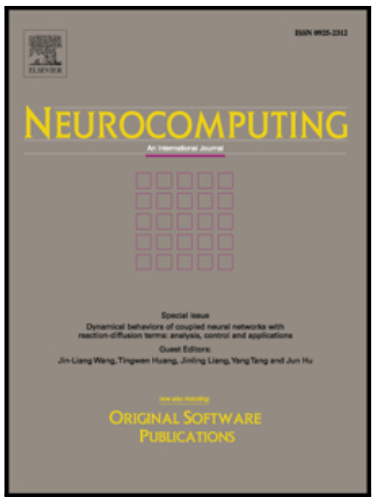

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Hyung-Jun Yim , Dongmin Seo , Hanmin Jung , Moon-Ki Back , InA Kim , Kyu-Chul Lee

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ACCEPTED MANUSCRIPT

Description and Classification for Facilitating Interoperability of Heterogeneous Data/Events/Services in the Internet of Things

Hyung-Jun Yim[1], Dongmin Seo[1], Hanmin Jung[1], Moon-Ki Back[2], InA Kim[2], Kyu-Chul Lee[2*]

[1]HPC-enabled Convergence Technology Research Division, Korea Institute of Science and Technology Information, Daejeon, Republic of Korea

[2]Dept. of Computer Engineering, Chungnam National University, Daejeon, Republic of Korea

{hjyim, dmseo, jhm}@kisti.re.kr, {zmzment, dodary0214}@gmail.com, kclee@cnu.ac.kr

[*]Corresponding author

Abstract

The Internet of Things (IoT) refers to an infrastructure that integrates things over standard wired/wireless networks and allows them to exchange information with each other. The IoT is a very complex heterogeneous network, enabling seamless integration of these things is a huge challenge. A publish/subscribe method of integration can be formulated to solve the problems of interconnecting billions of heterogeneous things. In our work, an IoT framework that uses an abstraction layer that decouples an application from the service calls and network interfaces required to send and receive messages on a particular thing. This paper provides definitions and classifications for heterogeneous data/events/services according to the properties of the things in order to integrate them into a framework for description. Based on these definitions and classifications, heterogeneous data/events/services in the IoT were integrated via topic description through the Data Distribution Service (DDS) middleware standard for real-time publish/subscribe. This paper also concludes with general remarks and a discussion of future work.

Keywords

Internet of Things (IoT); Data Distribution Service (DDS); Topic; Description; Interoperability

1. Introduction

The Internet of Things (IoT) is the network infrastructure of physical things that contain embedded technology allowing them to communicate and interact with each other [1][2]. There are many different groups that have defined the IoT. The MIT Auto-ID Center defines the term “Internet of Things” as a system in which the Internet is connected to the physical world via sensors and actuators based on Radio-Frequency Identification (RFID), enabling all physical things to act as nodes in a networked physical world [3]. According to the ITU’s Telecommunication Standardization Sector (ITU-T), the IoT is a technological revolution that represents the future of computing and communications; its development depends on dynamic technical innovation in a number of important fields, from wireless sensors to nanotechnology [4]. In the European Commission, the IoT uses an intellectual interface for things to communicate and connect through social, environmental and user contexts [5].

Things, in the IoT, can refer to physical objects such as sensors, actuators and devices embedded with electronics, software and connectivity to enable the things to achieve greater value and service by exchanging data. We use terms, “things” to give the same meaning as they are frequently used in the IoT related research papers. Other terms used by the research community are “objects”, “smart objects”, “devices”, and “nodes”. As shown in Fig. 1, we defined the things as features that: i) Each thing may comprise one or more data, events and services. A thing is a piece of equipment with the mandatory capabilities of sensing, actuation, data capture, data storage, data processing and communication. We defined the things are classified into data (sensors), events (accentures) and services (actuators) according to the type of action. In the IoT, data refers to attribute values such as variables and to integer values; events refer to when certain conditions are met or when certain states are reached. Services allow certain functions to be carried out through a predefined

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