

A Conceptual Extension of the Internet of Things Architecture and Its Standardization Reference Model

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Abstract

This paper tries to extend the conventional conceptual architecture of the Internet of Things in order to implement an advanced pervasive community computing platform, which is called “process-aware Internet of Things (IoT)”. The extended conceptual architecture is embodied in a standardization reference model through a conceptual integration of the Internet of Things and the process automations. Conclusively, we briefly describe the process-aware IoT platform and its standardization reference model to be applied to IoT-based pervasive computing systems and environments.

Keywords: Pervasive community computing model, Internet of Things, ITU-T IoT framework & architecture

1. Introduction

The little gadgets have become an integral and intimate part of everyday life for many millions of people, even more than the internet. This phenomenon is igniting a significant development of future pervasive computing platforms. After all, the collaborative works of the IoT-related study groups and focus groups of

ITU-T have recently delivered the conceptual idea and its architectural reference model[1] of the Internet of Things[1]. However, they have never delivered any type of feasible modeling methodologies to describe, control, and enact the goals to be accomplished by a group of collaborative smart objects over the computerized situation or space. Therefore, in this paper, we are trying to propose an advanced

and novel pervasive community computing platform, which is called process-aware Internet of Things, by extending the conventional conceptual architecture of the Internet of Things. The proposed platform plays an important role as a focal methodology to describe, control, and enact the communities' goals on the IoT-based infrastructures and environments. We also give a conceptual description of the process-driven IoT-community framework[2] extended from the standardized Internet of Things framework announced by the ITU-T.

2. An Extended Conceptual Architecture

2.1 The Process-Aware Internet of Things

In this section, we propose a conceptual architecture about process-aware Internet of Things. The conceptual architecture is devised to integrate the concept of process-driven collaborative communities into the standardized framework[1] of the Internet of Things. In order to this architecture need to revise the ITU-T's standardized architectural framework for the Internet of Things by conceptually converging the concept of process automation[3,4] as a means for describing and enacting the communities' goals.

Fig. 1 describes the conceptual architecture of process-driven pervasive IoT-community computing environment based upon the ITU-T's standardized IoT framework[1]. This framework consists of physical society, virtual society, and process-driven collaborative communities. The physical society is arranged into a networked group of physical Things. The virtual society is formed by a group of virtual or logical Things

that is mapped with physical Things through the Internet. A pervasive IoT-community computing environment is physically configured by a group of equipments, like devices, sensors, actuators and others, on a pervasive and mobile communications networking environment.

2.2 The Pervasive Process Model

In this section, we expatiate the pervasive process model by constructing a generic meta-model to be used to build a process-driven IoT-community goal.

The major entity-types of meta-model of pervasive process model are process-driven goal, task, member and condition. The **process-driven goal** is defined by a predefined or intended set of tasks or roles, called activities, and their temporal ordering of executions. And a process-driven goal can be described by a set of temporal orders of the associated activities (conjunctive logics, disjunctive logics, loop logics). The **task**[5] is a semantic entity of the basic unit of work (activity or role). The **member** is a conceptual entity type representing the virtual Things, each of which takes in charge of performing a certain role in completing a corresponding process-driven goal. The **condition** is a required entity-type to perform tasks of the process-driven goal. The relevant-data conditions on each task are matched to a pair of input and output data required as pre-conditions and post-conditions for the execution of the task, whereas the transition conditions on the alternative gateway edges are needed to select control-paths on the disjunctive gateway task or the loop gateway task.

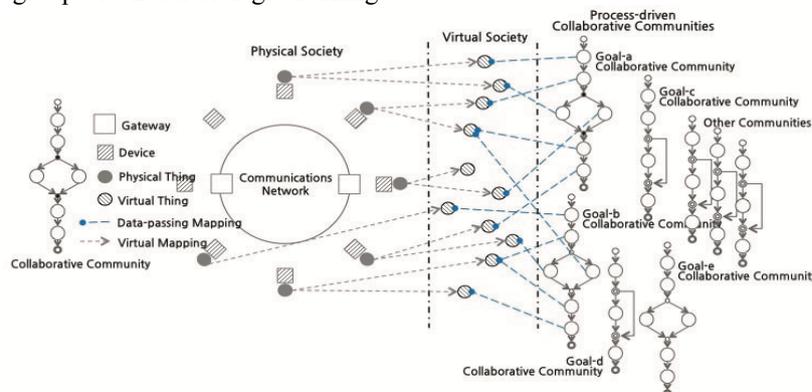


Fig. 1. A Conceptual Architecture of the Process-Aware Internet of Things

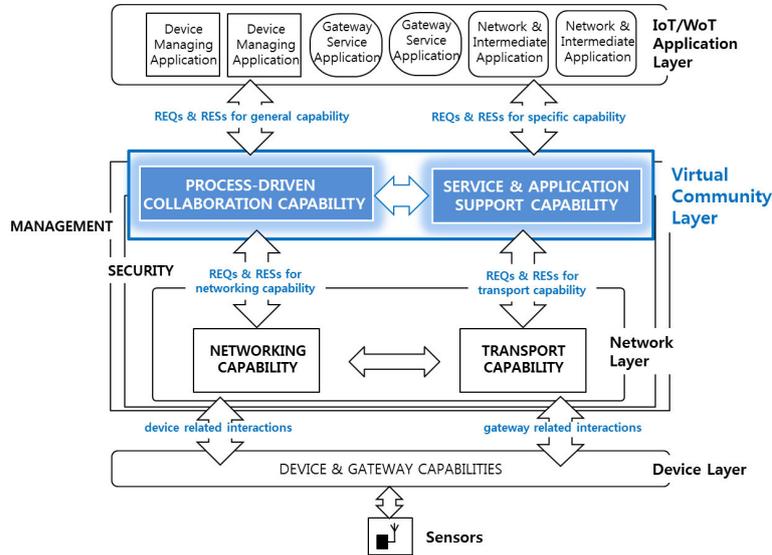


Fig. 2. A Standardization Reference Model for the Process-Aware Internet of Things Architecture

3. A Standardization Reference Model

This section describes a standardization reference model for supporting the new type of IoT-community computing architecture to be implemented as the IoT infrastructures and platforms.

Fig. 2 illustrates a fundamental reference model that becomes an eventual architecture for the proposed Internet of Things platform supporting the pervasive process-driven community computing systems and environments. As you see, the reference model is comprised of four architectural layers, such as device, network, virtual-community, and IoT-application layers, in order to realize the proposed IoT conceptual platform of **Fig. 2**. The device and network layers are corresponding to the physical-Things and their connecting network, respectively. The virtual-community layer takes in charge of managing the pervasive process-driven communities and linking to the IoT-applications through the activities of the underlying process, as well.

4. Conclusions

In this paper, we suggested a possible way of describing a process-driven goal to be achieved by the pervasive collaboration community organized in the infrastructure of the Internet of Things. So, we tried to revise the ITU-T's standardized conceptual architecture of the Internet of Things by conceptually integrating the concept of process automation, and propose a standardization reference model to implement the process-aware IoT-community computing systems.

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