Chapter 15

MUSPEL: Generation of Applications to Interconnect Heterogeneous Objects Using Model-Driven Engineering

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ABSTRACT

Internet of Things (IoT) is a paradigm that promotes a world in which smart objects and electronic devices communicate and coordinate autonomously to perform a wide range of tasks. From a technical point of view, the development of IoT systems is not an easy task; due to the great heterogeneity among smart objects and the large number of technologies applied, the developers of these systems must have strong technical knowledge. In this chapter, the authors use the eclipse modelling framework to define a domain-specific language that allows specifying the coordination and communication between different types of smart objects, regardless of the smart object technical characteristics. The proposed domain specific language has been designed to be used in an intuitive and easy way for people without technical knowledge. This solution aims to be useful in many areas and to achieve constant adaptation and evolution of IoT systems.

INTRODUCTION

A great percentage of people have Smartphones (Fundación Telefónica, 2014) or similar Smart Objects. In our houses, we have computers, laptops, Smart TVs, micro-controllers or tablets. Some factories are using Smart Labels, NFC and RFID for controlling their production through using of Smart Objects. Others companies using this Smart Labels and others objects to automate processes through robots. A clear example of this is Amazon. We can combine these objects and ideas with Internet and we open the door to the concept with the name Internet of Things (IoT) (Han, Jornet, Fadel, & Akyildiz, 2013; Hribernik, Ghrairi, Hans, & Thoben, 2011; Tan, 2010).
All this give both users and developers endless possibilities in many fields: Smart Cities (Hao, Lei, & Yan, 2012) or Smart Homes (Gu & Wang, 2009; Han et al., 2013; Hribernik et al., 2011), better known as Smart Earth (Hao et al., 2012), environmental intelligence (Gu & Wang, 2009) and many others. The examples need process automation. All this is achieved by the interconnection and identification of objects using their different sensors and protocols. This way, objects can interact among themselves, with or without the user interaction, but always they offer performing tasks in an easier way or even automatically. In some cases, it is according to the user preferences.

At present existing multiples examples with prototype that use Smart Objects, sensors and Smart Label to interconnect daily life objects with us. We can encounter fridges, cars, freezers, lights, plugs, doors, windows, houses or plants. For example, if this is applied to food, information about it can be given to other mechanisms in a simple way. A fridge would be able to send mails to the cellular phone, informing about the amount of food stored inside or the products that are about to expire, thanks to the reading of the information (Rothensee, 2007). All this is possible if the food has a Smart Label (NFC or RFID) and the fridge has a reader, a computation unit that can perform the suitable actions and an Internet connection (Gu & Wang, 2009).

In the same way that it is applied to a fridge, this technology can be used with other elements: as the house itself and its conditions when we are outside (Hribernik et al., 2011); the work, such as the automation of a forklift in (Hribernik et al., 2011); cities, for example, in China such as C.Hao says in (Hao et al., 2012); the supermarkets and shops to improve the way to bring their inventory or give information to their clients. All that is needed is to joint those smart object by using the suitable sensors.

Internet of Things does not just present small-scale utilities at houses and shops but there are also some systems and IoT initiatives that include buildings and even integral cities.

Luxembourg, Aarhus, Turku, Aalborg, Odense, Tampere, Oulu, Eindhoven or Oviedo are various of the multiple Smart Cities that Vienna University of Technology is studying (Vienna University of Technology, 2013). In this ranking, the cities are evaluating by six characteristics: economy, mobility, environment, people, living and governance. All of these are Smart Cities (Hao et al., 2012) and they use sensors and others smart objects in order to perform different tasks to facilitate the city life.

Humidity, temperature, ozone, movement, pressure capacity, gas, noise, light or pollution are different kinds of sensors that can obtain real-time information about the city condition. Traffic, parking, timetables about Smart city transport (Falvo, Lamedica, & Ruvio, 2012), environmental danger, lack of trash recycling, the quality of the water, light control, traffic control, reduction of CO₂, saving or the access to hospitals are different possible notices, warnings or alerts that the people can receive thanks to the combination of Smart Object and sensors in the cities.

For example, when a certain temperature is reached, the air-conditioning can be activated or the windows can be opened if it is not windy or rainy outside. Also, this information can be sent to Internet and the users within the affected zone can be notified by sending information or using smart labels that send the information to users with nearby compatible mechanisms.

By using other sensors (like those that react to movement) and the consignment of information to a process station and the cloud, both the traffic and the parkings can be controlled, and they also can offer or send information to the citizen, who will decide how they want to move.
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