Chapter 4

Using Model-Driven Architecture Principles to Generate Applications based on Interconnecting Smart Objects and Sensors

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ABSTRACT

There has been a rise in the quantity of Smart Things present in our daily life: Smartphones, smart TVs, sensor networks, smart appliances, and many other home and industry automation devices. The disadvantage is that each one is similar but very different from the others because they use different kinds of connections, different protocols, different hardware, and different operative systems; even if they belong to a similar kind, and depending on the manufacturer, two Smartphones or two humidity sensors can be totally different. In spite of this, they all have something in common: All can be connected to Internet. This fact is what gives power to objects, because it allows them to interact with each other and with the environment by intercommunication, a joint and synchronized work. That is why the key resides in creating connections among different objects. This requires technical and qualified personal, although the majority of people who use it do not meet these conditions. These people require objects that are easy to interact with and with as many automations as possible.
INTRODUCTION

Most people have Smartphones or other intelligent mechanisms, like Smart TVs, Smart Labels (NFC, RFID). This opens new doors to know the Internet of things.

Thank to these mechanisms, users can receive totally personalized notifications almost instantly, through an application, a message, a call, a code or by consulting a Web service. Also, this gives the user the possibility to interact with other mechanisms in a much more easy way. For example, he can send a photo from his tablet to a Smart TV with a simple movement of the photo, ‘throwing’ it towards the Smart TV.

All this give both the user and the developer endless possibilities. In our case, with a view to process automatization, notifications, references, and configurations, 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’s interaction, but always performing tasks in an easier way or even automatically, according to the user’s preferences.

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, cities, 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.

Madrid, Santander, Málaga, Barcelona, Luxembourg, Aarhus, Turku, Beijing… (Vienna, 2013) All of these are smart cities (Hao, Lei, & Yan, 2012) and they use sensors and others smart things in order to perform different tasks.

Humidity, temperature, ozone, movement, pressure capacity, gas, noise, light, pollution… There are different kinds of sensors that can obtain real-time information about the city’s 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 CO$_2$, energy saving, access to hospitals… All this is possible 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.

In order to create a smart city, not everything has to be based on ordinary things, private things, can be also included. Also, each citizen can provide several sensors and install them in different places of their houses. For example, temperature and humidity sensors on a balcony. Other citizen could as well get access to this data if it is public and, following the same system, a page where the city map is selected, it is possible to observe the
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