New Trends in Intelligent Software Methodologies, Tools and Techniques
H. Fujita and E. Herrera-Viedma (Eds.)
IOS Press, 2018

doi:10.3233/978-1-61499-900-3-17

Model Driven Evolution of an Agent-Based Home Energy Management System

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Abstract. Advanced smart home appliances and new models of energy tariffs imposed by energy providers pose new challenges in the automation of home energy management. Users need some assistant tool that helps them to make complex decisions with different goals, depending on the current situation. Multi-agent systems have proved to be a suitable technology to develop self-management systems, able to take the most adequate decision under different context-dependent situations, like the home energy management. The heterogeneity of home appliances and also the changes in the energy policies of providers introduce the necessity of explicitly modeling this variability. But, multi-agent systems lack of mechanisms to effectively deal with the different degrees of variability required by these kinds of systems. Software Product Line technologies, including variability models, has been successfully applied to different domains to explicitly model any kind of variability. We have defined a software product line development process that performs a model driven generation of agents embedded in heterogeneous smart objects with different degrees of self-management. However, once deployed, the home energy assistant system has to be able to evolve to self-adapt its decision making or devices to new requirements. So, in this paper we propose a model driven mechanism to automatically manage the evolution of multi-agent systems distributed among several devices.

Keywords. Software Product Line, Self-adaptation, Internet of Things, MAS-PL

1. Introduction

Residential buildings represent the most important part of the energy consumption and the greenhouse effect of more populated areas. The inhabitants are confronted to a variable set of tariffs of energy and some heater set points effects according to hour and days and to energy suppliers and producers [5,10]. In this dynamic context of energy production and consumption, a home equipped with an automated system to manage the energy-related tasks takes its importance. Home automation consists in automating the ability to control items around a house with a simple button, a voice command or a temporized power socket. So, a Home Automation system basically consists of a set of home appliances and personal devices linked via a wireless communication network allowing interactions for control and data interchange purposes. Some activities, like installing a

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