A Comparative Study of Aspect-Oriented and Object-Oriented Implementations: Pervasive System Use Case

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Abstract. Pervasive computing is becoming a reality. On the one hand, they will be deployed into a diversity of small devices and appliances, and on the other hand, they must be aware of highly changing execution contexts. Adaptation is the key crosscutting concern of pervasive computing applications. In this paper, we discuss our experience of implementing an adaptive display environment using Aspect-oriented programming. We compare the aspect-oriented implementation with independently developed object-oriented implementation of the environment. The comparison demonstrates that an aspect-oriented approach is indeed more effective in modularizing adaptation in a reusable, maintainable and evolvable fashion. It also reduces the complexity of the implementation with respect to the above three desirable attributes. At the same time, our experience challenges some of the existing conceptions about aspect granularity within an application and also highlights the need for development guidelines and idioms.

Keywords: pervasive computing, adaptation, crosscutting properties, aspect-oriented and object-oriented implementation.

1 Introduction

Pervasive systems will be naturally integrated as part of our environment. In pervasive systems we can found a great diversity of computing facilities (computers, PDAs, smartphones, sensors and so on) and high diversity of networks technologies (mobiles ad-hoc networks, sensors/ actuators, etc). This means that a pervasive application have to deal with static and dynamic changes, so its architecture should be well modularized to facilitate its adaptation to the evolution of devices and environment. Then is a big problem how to tackle these high diversity environments.

Regarding this issue we can resume the main problems of pervasive systems in:

- Hardware heterogeneity: the embedded systems and mobiles devices have different capacities and constraints, such as the amount of available memory, communications kinds or computations capacity.
- Dynamism of the application environments: the pervasive system has to be able to react in an automatic way to the environment changes, i.e. they must support a dynamic auto-adaptation and reconfiguration.

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