

Chapter XV

Administration of Wireless Software Components

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ABSTRACT

Software components embedded in mobile and wireless devices, as ordinary components deployed in distributed systems, have to be managed in order to recover faults, to trace and analyze behaviors, to enable business services such as online maintenance, customer practice understanding and so on. Despite the existence of management standards and platforms, the implementation of management facilities inside components as well as the possibility to access and operate these facilities by means of appropriate interfaces (a configuration interface for instance in order to instrument dynamical re-configuration) are not actually available. In this scope, this chapter discusses and provides a design method and an associated Java library in order to have manageable and self-manageable components specific to mobile and wireless environments.

INTRODUCTION

A major trend concerning the mobile system industry is the need for designing software applications as assemblies of reusable components, such as Java components in J2ME environments and C# components in Windows CE environments. Components are interconnected

through well-defined interfaces, while their implementation remains hidden. This results in increased reuse, easy isolation of faults, and overall improvement of quality and reliability. Furthermore, it also enables components to be independently deployed by third parties. Deployment occurs on various devices such as mobile phones, personal digital assistants

(PDAs), set-top boxes, smart cards, and so on. Owing to the fact that mobile deployment environments are different from development environments, abnormal behaviors and/or misuses occur. Consequently, some deferred assessment is only possible if components have been endowed with remote administration capabilities, including state and behavior supervision, even control, at the time components face unstable execution contexts.

From a business perspective, such a global approach is a way for supporting and thus for offering better customer services: better start-up processes, analysis of deficiencies, possible corrections through (re)configurations, marketing-based studies of common practices and expectations, and so forth. All of the well-known qualities of the component-based development technology (National Coordination Office for Information Technology Research and Development, 2001; Szyperski, Gruntz, & Murer, 2002) seem promising to achieve the necessary flexibility and adaptability imposed by the mobile systems' market.

The purpose of this chapter is to propose appropriate concepts, techniques, and tools to manage component behaviors and their associated interactions within wireless devices. Management activities stress component behavior tracing and possible dynamic (re)configuration in order to ensure actual supervision and control of mobile devices. Some of the contribution comes from the results of the Component+ European project (www.component-plus.org) in which the idea of Built-In Test (Barbier, 2005) has been formalized, developed, and put into practice for multimedia software components.

This chapter extends some of the ideas relating to the BIT technology that initially does not support administration facilities. We especially deal with the notion of “wireless software component.” Even if this expression may *a*

priori not make sense, we here mean software components deployed in wireless systems. The chapter is organized in three main parts. The first part reviews the current relation between CBSE and software for mobile systems. After justifying an interesting potential synergy between the two domains, a discussion about component management architecture standards as Java Management eXtensions or JMX (Sun Microsystems, 2002; Kreger, Harold, & Williamson, 2003) is proposed. This first part ends with a focus on UML 2 in particular and executable modeling language in general, in order to answer the question: What could be a suitable technical framework for wireless component administration?

While the second part of the chapter exposes our contribution in terms of executability of the UML 2 notation and its inherent implementation for component administration, the third and final part deals with a fully implemented case study—a home automation system, including a complex wireless software component corresponding to a programmable thermostat. The state machine diagram of this component is in the Appendix. For illustration purposes, screen shots are offered, especially those relating to the programmable thermostat's management activities in Web browsers.

SOFTWARE FOR MOBILE AND WIRELESS DEVICES: AN OVERVIEW

Nowadays, a great diversity of mobile devices is offered to consumers in different market segments such as telephony, digital interactive television, home automation, and automotive industry. Each device category uses specific hardware architectures and equipment to better fit customer requirements. For instance, PDAs use more powerful processors than mobile

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