Chapter X
Smart Items in Real Time Enterprises

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ABSTRACT

This chapter deals with the idea of how—as we call them—"smart items" can contribute to the overall vision of the real time enterprise by utilizing ubiquitous computing (UC) technologies. First, an overview of functionality is given that smart items can offer to improve enterprise business processes. The discussed capabilities making everyday objects or goods "smart" are grouped into categories called Information Storage, Information Collection, Communication, Information Processing and Performance of Actions. This is followed by an overview of ways in which enterprise businesses processes can profit from these capabilities. The consistent and reliable integration of smart items into traditional enterprise software systems requires the implementation of a middleware layer. An important goal of the middleware is to hide technology specifics of ubiquitous computing systems from the applications that rely on them. The approach described is service orientation which allows the consistent encapsulation and standardized usage of the required functionality in a given business process.

INTRODUCTION

As you may know, in today's enterprises many business processes are supported by software systems. Just think of a system that automatically orders machine spare parts ensuring continuous production, and at the same time optimizes warehouse utilization and asset costs of the given company. Traditional enterprise software systems rely on manual collection of data. Since manual data collection is in many cases error prone (think of mistyped product codes, for example), software systems often do not have the correct information to take the best decisions in a given situation. Consequently, this has a negative effect on the quality of the business processes they implement. Examples are delayed order fulfillment, trouble with customers, increasing storage costs, or out of stock situations.

When using UC technologies, this situation can be improved: UC technology may help the company capture the status of the enterprise more adequately, or even exactly in the ideal case, and represent in software systems what is happening in reality.

To reach this goal, physical items of the real enterprise environment, such as machine spare parts, and also warehouse shelves and gates, can provide some "smart" functionality extending the entire software system landscape down to the point of action. For example: When arriving at or leaving the warehouse, machine spare parts can automatically reveal their identity to the respective warehouse gate without any human interaction. Based on this information, warehouse inventory can always be up-to-date, helping avoid the "out of stock" nightmare.

To turn this vision into reality, there are many technical problems to solve. This includes the seamless integration of UC technologies and devices into companies' overall IT system landscape. There are many different ways to achieve this goal. In this chapter we stress a service-oriented middleware approach that helps span the technological gap between smart items and the targeted enterprise software systems.

The chapter is organized as follows: First, we take a closer look at smart items and categorize their functionality they can offer for business processes. This is followed by a definition of the term business process and the description of generic ways that business processes can profit from smart items functionality. Afterwards we motivate the service-oriented handling and integration of UC technologies in real enterprise environments. An important technical prerequisite for that is the implementation of a proper middleware layer, which we will describe in detail. Special emphasis will be placed on how to invoke and execute services provided by one or more smart items. Another aspect will be how services can be deployed and managed during all day operation.

SMART ITEMS

Continuous technological progress towards cheaper, smaller and faster hardware enables the construction of miniature computers that can be embedded in real world objects (Mattern, 2005). The resulting "smart items" consist of a physical component (that is the object itself) and an information-processing component, which enables the object to act in some sense intelligently.

There is a broad range of possible smartly acting things, including funny toys or components of intelligent homes. In enterprise environments—which we focus on—some possible objects include:

- Production machinery components
- Transport and storage containers, such as bottles, boxes, or pallets
- Shelves in warehouses or on shop floors
- Buildings including doors, gates, or rooms
- Any product items, including consumer goods
- Vehicles, such as trucks, cars, locomotives, air planes, or any of their parts

"Smart" items or more precisely, the miniature computers attached to or embedded into them, should provide functionality useful for the given business. Therefore, in order to complete the definition of what a smart item is, and thus what it is good for, we collected and classified the most relevant functionalities smart items can offer in five main categories. These are information storage, information collection, communication, information processing, and performance of actions.

It is important to note that a smart item can offer any meaningful subset and combination of these functional elements depending on given requirements, technical possibilities and affordable costs.

Information Storage

In companies operating with traditional information systems, data about business objects is usually stored in large centralized databases. Normally,

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