Chapter 1.3
Pervasive Computing:
What is it Anyway?

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ABSTRACT

In this chapter, we introduce the key ideas related to the paradigm of pervasive computing. We discuss its concepts, challenges, and current solutions by dividing it into four research areas. Such division is how we were able to understand what really is involved in pervasive computing at different levels. Our intent is to provide readers with introductory theoretical support in the selected research areas to aid them in their studies of pervasive computing. Within this context, we hope the chapter can be helpful for researchers of pervasive computing, mainly for the beginners, and for students and professors in their academic activities.

INSIDE CHAPTER

The recent advances in hardware and wireless technologies have leveraged the creation of the first experimental pervasive computing scenarios. Due to the belief that these scenarios will be an integral part of future living, research in this field is increasing at a fast pace. Therefore, theoretical

and mainly practical studies are of great use as a way of supporting this belief.

Performing such studies, however, implies identifying the intricacies behind pervasive computing. Although its concept is quite simple, understanding these intricacies is a task which scatters across different research fields. Computer networks, distributed and cognitive systems, software engineering, and user interface design are some of these fields.

Therefore, in this chapter our main objective is to identify and discuss, at an introductory level, some of these intricacies. More specifically, we define four major research areas in pervasive computing, namely pervasive networking, context awareness, pervasive systems development, and pervasive computing middleware. Based on this view, we then take the reader on a journey through the universe of pervasive computing, discussing concepts, challenges, and current solutions.

INTRODUCTION

Today, computing is facing a significant revolution. There is a clear migration from the traditional desktop-based computing to the ubiquitous era, where computing will be spread all around us and seamlessly integrated into our lives. It is this new stage of computing that researchers have named pervasive computing. We can say that it is the accomplishment of the so-called concept of *calm technology* (Weiser & Brown, 1995), or as Weiser (1993) has said, it "envisions computation primarily in the background where it may not even be noticed" (p. 1). Not surprisingly, these ideas require us to view computers in a totally different way, not only as something we log onto, work on, and log out of when we are finished (Saha & Mukherjee, 2003). Instead, we should see a computer as a portal to a repository of computational resources, making use of them to work on the background and fulfill tasks according to our needs and preferences.

Pervasive computing, also known as ubiquitous computing (Weiser, 1991), has been recognized as the third wave in computer science, following the mainframe and the personal computer ages. Therefore, even if not fully conceived, pervasive computing will be the prevailing paradigm of the 21st century. Observing the graph shown in Figure 1[1], one can see the sales associated with ubiquitous computing devices follow a fast exponential growth. As more and more facilities, or services, will be available for users of such devices, this growth, even that in a lower rate, will be expected to continue. After all, it is not for nothing that academy and mainly industry are so confident on the pervasive computing paradigm.

Getting a ride on this new trend, the purpose of this chapter is to conduct the reader behind the scenes of pervasive computing, introducing the main concepts and challenges involved in it. The structure of the chapter is illustrated in Figure 2. We start with a first glance at pervasive computing by describing a sample scenario in order to provide the reader with the general concepts. It is presented as an overview of the technological advances that have leveraged the development of pervasive systems, as well as the challenges imposed by pervasive computing scenarios. In the Pervasive Networking section, we present two key concepts for pervasive environments, mobility and host discovery. The notion of context and its importance to pervasive computing will be outlined in the Context in Pervasive Computing section. Next, we present some methods that have been used for developing pervasive systems. More specifically, some techniques that application developers need in order to deal with the inherent characteristics of software for pervasive computing are discussed. Based on this discussion, we then outline in the Middleware for Pervasive Computing section the main features that should be presented by a pervasive computing middleware and how they can aid the development of pervasive applications. Additionally, some pervasive computing middleware solutions are presented. We conclude

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