Chapter I
Ubiquitous Computing History, Development, and Scenarios

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ABSTRACT

This chapter gives a brief history of ubiquitous computing, highlights key issues, and assesses ubiquitous computing research and development under the broad categories of design architecture and systems, implementation challenges, and user issues. Using Singapore as a case example, the chapter then concludes with selected scenarios, presenting exciting possibilities in the future ubiquitous landscape.

INTRODUCTION

History and Vision of Ubiquitous Computing

Technology in computing has undergone extensive changes over the years. In the early 1970s, mainframe computers dominated the computing scene based on the principle of one computer serving many people. In the 1980s, mainframe computers gave way to personal computers and notebooks, and, in contrast, the emphasis was one computer to one person. In the 1990s, with increased computing powers available at affordable prices, we are witnessing a new era of personal computing, that is, a phenomenon in which multiple computers are serving one person.

Through the ages, technology has dramatically transformed our lives, changing the way we learn, live, work, and play. Technology shrank transistors to such microscopic sizes that they enable computer chips to be found in the things we use daily, even down to a pair of shoes made by Adidas (McCarthy, 2005). Technology also connects computers around the world breaking down geographical boundaries as people are able to "travel" virtually everywhere, collaborate with others online, and be connected with loved ones virtually even though they may be miles away physically.

Mark Weiser (1991; 1993a; 1993b), father of "ubiquitous computing" (or "ubicomp" in short), coined the term "ubiquitous" to refer to the trend that humans interact no longer with one computer at a time, but rather with a dynamic set of small networked computers, often invisible and embodied in everyday objects in the environment. Keefe and Zucker (2003) see ubicomp as a technology that enables information to be accessible any time and anywhere and uses sensors to interact with and control the environment without users' intervention. An example often cited is that of a domestic ubicomp environment in which interconnected lighting and environmental controls incorporate personal biometric monitors interwoven into clothing so that illumination and heating conditions in a room might be modulated according to "needs" of the wearer of such clothing.

Other examples of ubiquitous environment include applications in homes, shopping centres, offices, schools, sports hall, vehicles, bikes, and so forth. The principle guiding ubicomp is the creation of technology that brings computing to the background and not the foreground, making technology invisible. Philosophers like Heidegger (1955) called it "ready-to-hand" while Gadamer (1982) coined it "horizon." This means that people do not need to continually rationalize one's use of an ubicomp system, because once having learned about its use sufficiently, one ceases to be aware of it. It is literally visible, effectively invisible in the same way, for example, a skilled carpenter engaged in his work might use a hammer without consciously planning each swing. Hence, ubicomp defines a paradigm shift in which technology becomes invisible, embedded and integrated into our everyday lives, allowing people to interact with devices in the environment more naturally.

CURRENT RESEARCH CHALLENGES

Research challenges in ubicomp remain interdisciplinary, and this is evident as we trace the development of the Ubicomp Conference Series into its ninth year in 2007. The conference series began as Handheld and Ubiquitous Computing in 1999, focusing on areas relating to the design, implementation, application, and evaluation of ubicomp technologies, a cross-fertilization of a variety of disciplines exploring the frontiers of computing as it moves beyond the desktop and becomes increasingly interwoven into the fabrics of our lives. Over the years, the Ubicomp Conference Series from 1999 – 2006 has grown in participation by region, with papers addressing more