Toward A Generic Infrastructure for Ubiquitous Computing

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ABSTRACT

The recent technological overhangs have focused on the democratization of wireless networks and the miniaturization of communication devices. In this context, Ubiquitous Computing is a recent paradigm whose objective is to allow users to access data, and make information available anywhere and at any time. In other terms, Pervasive Information Systems (PIS) constitute an emerging class of Information Systems where Information Technology is gradually embedded in the physical environment, capable of accommodating user needs and wants when desired. PIS differ from Desktop Information Systems (DIS) in that they encompass a complex, dynamic environment composed of multiple artifacts instead of Personal Computers only, capable of perceiving contextual information instead of simple user input, and supporting mobility instead of stationary services. In this paper, as an initial step, the authors present PIS novel characteristics compared to traditional desktop information systems; the authors explore this domain by offering a list of challenges and concepts of ubiquitous computing that form the core elements of a pervasive environment. As a result of this work, a generic architecture for intelligent environment has been created. Based on various and related works concerning models and designs. This framework can be used to design any PIS instance.

Keywords: Ambient Intelligence, Design Pervasive Systems, Desktop Information Systems (DIS), Pervasive Information Systems (PIS), Ubiquitous Computing

1. INTRODUCTION

Ubiquitous computing is a research field of computing technology that started at the 90s of the last century with Mark Weiser’s seminal work entitled “The Computer for the 21st Century” Mark Weiser (1991). In this work, he shared his vision of a new way of thinking about computers. Ubiquitous Computing represents a new direction on the thinking about the integration and use of computers in people’s lives. It aims to achieve a new computing paradigm, one in which there is a high degree of pervasiveness and widespread availability of computers or other Information and Communications Technology (ICT) devices in the physical environment. As consequence, the physical world is enriched with the advantages of processing power, storage and communications capabilities of computers.

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The essence of Weiser’s vision is that persons use many computers embedded in the environment, allowing technology to recede into the background. The first era was defined by the mainframe computer, a single large time-shared computer owned by an organization and used by many people at the same time. Second, came the era of the PC, a personal computer primarily owned and used by one person, and dedicated to them. The third era, ubiquitous computing, representative of the present time, is characterized by the explosion of small networked portable computer products in the form of smart phones, personal digital assistants (PDAs), and embedded computers built into many of the devices we own resulting in a world in which each person owns and uses larger numbers of computers becoming integrated into everyday life. In addition communications extend beyond the classic concept man to man or man to machine, to include direct communication between machines, (Figure 1).

The remarkable recent progress in embedded devices, smart phones, wireless communications and networking technologies (Figure 2) has enabled us to create pervasive computing systems and services with diverse applications and global accessibility ClementESCOFFIER (2008), and promote their mobility in a transparent way without the explicit user intervention. This technological progress offers an opportunity to focus on its main task instead of configuring and managing all IT equipment at their disposal and access to various services offered by these objects, anywhere, at any various devices Ansem ben Cheikh (2012), Debashis Saha (2003), Satyanarayanan (2003).

This paper addresses the research issues associated with this vision of the future computing landscape. We introduce a generic architecture comprised of infrastructures, devices, interfaces, smart spaces and security that form the core elements of a pervasive information environment.

The rest of the paper is organized as follows, after reviewing the state of the pervasive computing. Section 2 formulates the definition and evolution of information systems and the main constraints of pervasive information systems, after we present PIS novel characteristics compared to traditional desktop information systems (DIS), Section 3 identify fundamental challenges, properties and characteristics of ubiquitous computing environments that form or are part of those environments. Section 4 reviews the background and related works for