Chapter 31
Model and Infrastructure for Communications in Context–Aware Services

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ABSTRACT

The appearance of concepts such as "Ambient Intelligent", "Ubiquitous Computing" and "Context-Awareness" is causing the development of a new type of services called "Context-Aware Services" that in turn may affect users of mobile communications. This technology revolution is a a complex process because of the heterogeneity of contents, devices, objects, technologies, resources and users that can coexist at the same local environment. The novel approach of our work is the development of a "Local Infrastructure" in order to provide intelligent, transparent and adaptable services to the user as well as to solve the problem of local context control. Two contributions will be presented: conceptual model for developing a local infrastructure and an architecture design to control the service offered by the local infrastructure. This infrastructure proposed consists of an intelligent device network to link the personal portable device with the contextual services. The device design is modular, flexible, scalable, adaptable and reconfigurable remotely in order to tolerate new demanding services whenever are needed. Finally, the result suggests that we will be able to develop a wide range of new and useful applications, not conceived at origin.

INTRODUCTION

Advances in digital electronics over the last decade have made faster, cheaper and smaller computers. This coupled with the revolution in communication technology has led the development and rapid market growth of embedded devices equipped with network interfaces. Due to this explosive growth in telecommunications infrastructure that facilitates seamless interaction between customers and service providers, personalization services in an intelligent system and ubiquitous computing environment are expected to emerge in many areas in our world (Lee 2009).

"Ambient Intelligent'' concept is oriented to make the environment intelligent (Shadbolt 2003; Weber 2005; Aarts 2008) and defines such as digital environments that are sensitive and responsive to the presence of people. In relation with this idea have emerged concepts such as "Ubiquitous Computing'', "Context-Awareness'', anthologies, agents, "Internet of Things" (Dolin 2006; Siorpaes 2006), and others.

Ubiquitous computing envisions the transformation of physical spaces into active information spaces. These ubiquitous smart spaces consist of various ubiquitous objects (devices and applications) and their collaborations that provide convenient and intelligent services for users (Lee 2009). This implementation has become technically feasible, thanks to rapid progress of network technologies and mobile communication devices. The ubiquity of mobile devices opens a user's operating environment, which adapt rapidly to the environment where the network topology or physical connections among hosts must be constantly recomputed. At this point, Mark Weiser defined in (Weiser 1991; Weiser 1993) the ubiquitous computing as "enhances use by making many computers available through the physical environment, while making them effectively invisible to the user". Besides, the evolution of technology is causing the development of a new type of services called "Context-Aware Services"

(Chen 2000) that in turn may affect users of mobile communications. These services allow users to get information adapted to their contexts, needs and preferences.

Providing services to mobile users is essential for many emerging pervasive computing applications. Provision of situation-specific service without user intervention requires an involved process for acquiring user's contexts. According to the current paradigm of ubiquitous computing, soon we will be able to access information and services virtually anywhere and at any time via new device, or even through our phones, PDAs, laptops or even watches. Thanks to this new technology revolution the environment will be intelligent enough to pick up user inputs like user movement, proximity or temperature and required service or information to the user through a mobile.

Users can be in a place, and at the same place, a user can do several activities and demands several services. For instance, a user can work, make a shopping, go sightseeing in the same city at the same environment, so it is necessary that the environment has intelligence to understand and process several user contexts. This is a complex process because of the heterogeneity of contents, devices, objects, technologies, resources and users. Therefore it is necessary to have a local control of these parameters. In this sense, Wide Area Networks are not sufficient to solve this problem since they are oriented to remote multimedia services, with no interaction between objects from the same environment. On the other hand, nowadays there are techniques and protocols supporting communication in mobile ad hoc networks, which are not sufficient to provide the capabilities that real-world context-aware applications require.

The use of context is important in interactive applications. It is particularly important for applications where the user context is changing rapidly, such as in both handheld and ubiquitous computing (Anind 2000). Schilit and Theimer (Schilit et. all 1994) refer to context as location, identities of nearby people and objects, and

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