Chapter 38
GlobalEdu:
Towards a Model for Ubiquitous Learning

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ABSTRACT

The application of ubiquitous technologies in the improvement of education strategies is called Ubiquitous Learning. The essence of Ubiquitous Learning is to realize which information can be presented throughout the learners' daily tasks, in different forms and places, and to link this data with the learners' educational process. Ubiquitous Learning can be used to support and stimulate K-20 education. It is independent of age, and it does not use any teacher-centered method. Ubiquitous learning stimulates the lifelong education through a strategy of self-directed learning. This scenario is attractive, but is not easily implemented. The authors have worked in a model to support it, called GlobalEdu. This chapter describes the model and its integration with two ubiquitous middleware projects: ISAM and LOCAL. They created a system prototype and applied it in two practical scenarios. In those cases, the system is positively evaluated, and the initial results attest to the system's usefulness.

INTRODUCTION

The user who carries mobile devices has the possibility of using the facilities of wireless technology, such as access resources anywhere. However, to provide this scenario, it is necessary to offer a uniform and immediate access to this information. In last years, studies about mobility and distributed computational systems have been stimulated by the proliferation of portable electronic devices (for example, cell phones, handheld computers, tablet PCs, and notebooks) and the use of interconnection technologies based on wireless communication (such as WiMAX, WiFi and bluetooth). This mobile and distributed paradigm is called *Mobile Computing* (Diaz,

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Merino and Rivas, 2009; Satyanarayanan et al., 2009). Moreover, the improvement and proliferation of *Location Systems* (Hightower & Borriello, 2001; Hightower, LaMarca and Smith, 2006) have motivated the adoption of solutions that consider the user's precise location for the provision of services (*Location-Based Services* (Dey et al., 2010; Vaughan-Nichols, 2009)).

The adoption of these technologies combined with the diffusion of sensors enabled the availability of computational services in specific contexts – *Context-aware Computing* (Baldauf, Dustdar, & Rosenberg, 2007; Dey, 2001; Hoareau & Satoh, 2009). The idea consists in the perception of characteristics related to the users and their surroundings. These characteristics are normally referred to as *context*, i.e., any information that can be used to describe the circumstances concerning an entity. Based on perceived context, the application can modify its behavior. This process, in which software modifies itself according to sensed data, is named *Adaptation* (Satyanarayanan, 2001). In this scenario, the *Ubiquitous Computing* initially introduced by Abowd and Mynatt (2000), Satyanarayanan (2001) and Weiser (1991) is becoming reality. The Ubiquitous Computing is a computational model that aims to pro-actively serve the needs of users, acting in an invisible way (background). The goal is to provide a continuous integration between technology and the environment, helping the user in his daily tasks. In this model, the applications are available regardless of place and time, and the access to the network and the computing environment is continuous, independent of the device and the physical location of the user.

The application of mobile and ubiquitous computing in the improvement of education strategies has created two research fronts called *Mobile Learning* and *Ubiquitous Learning*. *Mobile learning* (m-learning) (Tatar, 2003) is fundamentally about increasing learners' capability to carry their own learning environment along with them. M-learning is the natural evolution of e-learning, and has the potential to make learning even more widely accessible. In M-learning model, mobile computers are still not embedded in the learners' surrounding environment, and as such they cannot seamlessly obtain information about learner context. So, computers cannot obtain information about the context of learning from the learning environment where the small devices such as sensors, pads, badges, and so on, are embedded and communicate mutually (contextual information).

On the other hand, *Ubiquitous Learning* (Barbosa et al., 2011; Lewis et al., 2010; Ogata & Yano, 2009; Ogata et al., 2010; Rogers et al., 2005; Yin, Ogata, & Yano, 2004; Yin et al., 2010) refers to learning supported by the use of mobile and wireless communication technologies, sensors and location/tracking mechanisms, which work together to integrate learners with their environment. Ubiquitous learning environments connect virtual and real objects, people and events, in order to support a continuous, contextual and meaningful learning. A ubiquitous learning system can use embedded devices that communicate mutually to explore the context, and dynamically build models of their environments. While the learner is moving with mobile device, the system dynamically supports learning process by communicating with embedded computers in the environment. The opportunities made available by the context can be used to improve the learning experience. So, in this scenario, the mobility of learners and the perception of the elements that are near him (context) are part of the learning process, and this process can occur in a continuous, comprehensive and transparent way. Therefore, these environments support learning processes related to the situation involving the learner (context-aware (Dey, 2001)).

Ubiquitous Learning can be used to support and stimulate the teaching and learning in *K-20 Education*. Learning can occur anytime and anywhere and it is adjustable, continuous, and integrated

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