Chapter 9
Context-Aware Cloud Computing for Personal Learning Environment

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ABSTRACT

Virtual learning means to learn from social interactions in a virtual platform that enables people to study anywhere and at any time. Current Virtual Learning Environments (VLEs) are normally institution centric and are designed to support formal learning, which do not support lifelong learning. These limitations led to the research of Personal Learning Environments (PLEs), which are learner-centric and provide lifelong access as well as the ability of a user to produce (share) and consume information resources easily. In this research, a context-aware cloud based PLE architecture is proposed, which is driven by a Context-Aware Engine to acquire, filter and interpret context information based on the preferences defined in user profile, where cloud computing is taken as service infrastructure. An illustrative personal learning scenario is investigated to demonstrate the proof of concept implementation. The results show the benefits of the proposed architecture on resource utilisation and user experience.

1. INTRODUCTION

Virtual Learning Environments (VLEs) (Chavan, 2004) in the last decade have brought about the greatest changes in the delivery of education allowing learners to access multimedia course materials. However, VLEs are still institution-centric; they are designed to support formal learning; teachers control the materials and services that are made available to learners. These limitations that affect VLEs have led to the development of a new generation of VLE - the Personal Learning Environment (PLE) (Attwell, 2007).

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PLEs require a flexible learning environment which enables people to study anywhere at any time. In this sense, PLEs are a type of pervasive systems (ubiquitous computing). A context-aware PLE will be able to sense continuously the context of the user and use this context information to adapt its services to changing situations in a calm and non-obtrusive manner. Since cloud computing can provide wide access to broad storage of learning materials, facilities, and other services, cloud computing is becoming the preferred environment for PLEs with large scalability, dynamic collaboration and flexible resource requirements. With the significant advances in information and communications technology, mobile cloud computing has emerged as one of the fast growing segments of the IT industries. Mobile cloud computing is a kind of cloud-based context-aware system. A key challenge of the cloud based context-aware system is the increase of information in a given context.

In this research, a cloud based context-aware PLE is introduced and implemented. The concept of the research arises from activities in cloud computing, context-aware computing and PLE research. This research will link these three research themes and make significant new contributions. It is novel and timely for software to be adapted to take advantage of the advanced cloud based context-aware technology to support the development of the PLE system.

2. BACKGROUND

2.1 Personal Learning Environments

2.1.1 From Virtual Learning Environments to Personal Learning Environments

The definition of Virtual Learning Environments (VLEs) was proposed by Chavan (2004), which defined a VLE as a software system used to deliver online education, taking advantage of web-based methods and tools such as discussion forums, chats and automated tests. Many of other definitions given are similar, and typically focus on a particular characteristic of VLEs.

VLEs have become popular in higher education in recent years, due to their ability to provide additional and flexible solutions for students and researchers. The learners need not attend traditional, face to face activities in the classroom. Instead, the teaching and learning are done in a virtual space. The advantages of VLEs can be outlined below (Alharbi, 2013; Alharbi, 2014; Cheng, 1998; Kumar, 1998):

- VLEs can help institutions to reduce the practical pressures of finding enough physical space and resources for them.
- Unlike in traditional learning environments, the learners may study course modules at anytime and anywhere.
- VLEs are more economic than traditional learning. Students can study from home without going every day to a university and spending money on transport, etc.
- VLEs can provide access to education for those who have experienced barriers to it in the past, such as students who have special needs (disability) or family commitments.
- Educators can use VLEs to manage courses, thus connect the course participants so as to achieve both effective communication and collaboration. Via VLEs, students and lecturers can enjoy the convenience of using the online delivery of materials and resources.
- VLEs make education available to the broader population. Education is not restricted to only those students who are going to university, but is open to anyone who is interested in being educated via VLEs.

However, there are also some limitations (Alharbi, 2013; Alharbi, 2014; Taraghi, 2010; Zhao 2010; Zubrinic 2008), as addressed below: