Cloud Computing in the Education Environment for Developing Nations

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ABSTRACT

In developing nations where distance education is viewed with great interest, cloud computing provides a necessary solution in creating a 21st century educational environment. Cloud computing facilitates the use of open source in educational institutions in the online learning environment where the social web or software can be used to network institutions, libraries, and students in their homes. This approach enables remote laboratories for educational institutions, research, and industry. Combining this with a virtual platform will provide academic institutions the ability to provide instruction, and research establishment to conduct high level complex research. This paper presents the concept of laboratories at home as the authors see it in the light of cloud computing era, taking into account the existing norms and standards as well as achieve educational goals required for science and engineering laboratories with what can be referred to as Networked Smart Educational Devices.

INTRODUCTION

Educational institutions are constantly looking for ways to improve learning, making learning a very dynamic process. This has served societies well in that learning no longer takes place only in a classroom, but rather the classroom has been extended to include the environment. In this sense, many aspects of learning are no longer localized. Field trips have become an integral component of learning. Another form of learning that has added to the learning process is distance education.

In discussing distance education, one must consider the different disciplines and how well each lends itself to distance education. Disciplines that are laboratory intensive such as the sciences and engineering have included online laboratories including remote laboratories (Saliah-Hassane et al., 1999; Salzmann et al., 1999; Sepehri et al., 2011) in the distance learning format. One of the conditions that contribute
to constraint in this endeavour is safety. In this case it is always advisable to have a supervisor who is an expert in the field of study present during the laboratory exercise to guide the laboratory work. Another constraint is the cost of equipment which for some disciplines is very high considering the type of work being done.

The information age has advanced education beyond expectation as a result of the computer being used as a tool, no different from using a ruler as a tool to measure distances. The multi-tasking ability of the computer has proved to be invaluable in this case. The ability to network the computer in any one of the topologies of local area network (LAN), metropolitan area network (MAN), or wide area network (WAN) have added to the advantages the computer provides the education environment. To add to this is the wireless connectivity, wireless LAN (WLAN) that extends the facility to areas where wired connectivity can be problematic. These developments provide the requirements that will support labs at home (Saliah-Hassane et al., 2011), and for the same reasons cloud computing (Saliah-Hassane et al., 2006) have added to the emphasis.

To push the bounds even further in achieving what might have been impossible a few years ago is the introduction of Smart Technologies (Smart Technologies, 2013) to the education environment. Smart technologies have provided devices that have improved the interactive engagement in the education process. The products include smart interactive whiteboard, Smart projectors, Smart collaborative software, Smart wireless slate, and Smart interactive podium, to name a few. Two operative words among this list are interactive and collaborative. These two words are clear indication of activities being conducted in real time and in team atmosphere. This is not to say that individuals cannot do their work on their own. The intention however is to enable sharing of ideas, which is a useful process in the education environment. Putting all the above together makes available an education environment that will support learning at all levels from K-12 to university, and will also support researchers in their work.

As stated above, education is no longer localized. And to make it even more accessible to the learner, a team of researchers have introduced the Lab@Home (Saliah-Hassane et al., 2011) concept that brings the education process to the learner’s own environment, his/her home. The versatility of Lab@Home is it combines all the current developments and brings it to the learner, or researcher, at his or her home through cloud computing. Cloud computing is not a new technology, and has been discussed in an effort to bridge the digital divide in secondary education (Le Roux & Evans, 2011). The strength of Lab@Home is its ability to combine virtual instrumentation in its range of applications. This puts at the individual’s, or the team’s disposal access to expensive equipment that the individual or a less endowed institution may not be able to purchase.

Implementing the Lab@Home system in a developing nation will ensure that all parts/regions of that nation can be reached and education will no longer be available to only a percentage of the population of that nation (Wabwoba et al., 2011). This will give all the people of the nation access to libraries and research establishments worldwide. Education in such nations will be enhanced, greatly improving the nation’s chances of being an active participant in the global economy.

CLOUD COMPUTING

Among the many factors that make cloud computing attractive are the ability to share a pool of computing resources such as networks, servers, and applications, resulting in cost saving since resources can be shared. As suggested by the National Institute of Standards and Technology (NIST) (NIST, 2013), it is critical for government and industry to adopt this technology in dealing with difficult economic constraints. These are some of the reasons that make cloud computing an appropriate technology for developing nations to adopt. Coupling the above with the fact that smart educational devices can be deployed with this technology
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