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ITM 100
10/25/2019

Cloud-Computing in Distance Learning

Information Technologies are powerful enabling tools for educational progress, reform and new methods in teaching and conducting research. With the implementation of technology to improve educational systems, various IT infrastructure improvements are being introduced to educational institutes. One of these recent developments is cloud computing.

"A computing Cloud is a set of network enabled services, providing scalable, QoS guaranteed, normally personalized, inexpensive computing infrastructures on demand, which could be accessed in a simple and pervasive way" (Wang et al., 2008 p.139). Implementing cloud computing technologies to the education sector is projected to have a very significant impact on teaching and learning environments. These technologies are already seen in action, with cloud platforms such as "Microsoft" and "Google" providing free services to students and staff at educational institutions, including email, document storage, creation and sharing documents, as well as calendars and contact lists. Universities and higher education institutes, however, have begun to implement cloud computing technologies on a larger scale for learning, such as for distance learning. According to Keegan, & B.Holmberg (1998), distance learning is defined as educational tasks and lessons conducted through non contiguous communication between student and teacher, mediated by print or some form of technology. Distance learning, in modern day education, includes virtual classrooms, online lectures and online research and collaboration.

I. Benefits of Cloud Computing in Distance Learning

There are numerous benefits of using cloud computing for distance learning. They include:

1. **Cost Saving:** There are huge reductions in the installation of traditional IT system infrastructure. Westmont College reported that after deploying six cloud-centric service platforms, the benefits it achieved included a 65 percent cost reduction up front (over

more traditional deployments) and a 55 percent cost saving over the useful lifetime of the solutions (Sheard, 2010).

2. **Cost of setup and maintenance:** With technology advancing rapidly and new applications being invented continually, it becomes more difficult for distance learning IT staff to install, configure, secure and upgrade their technologies to the latest. Shifting to cloud computing moves the burden of technology setup and maintenance to cloud service providers instead of the distance learning IT staff, allowing them to allocate their time to more beneficial and creative use.
3. **Reallocation of resources:** Since DL IT staff are able to focus on developing innovative instructional solutions/resources and providing more support to faculty and students. IT staff can help instructors shifting to online and mobile instruction for their courses optimize the use of the available LMS systems to increase effectiveness and efficiency of the instructional process. IT staff can also assist instructors to integrate online conferencing tools such as Blackboard Collaborate to their teaching activities. They can also help faculty improve their technical skills in using various Web 2.0 tools (eg. blogs or wikis) and integrate these tools in their courses in order to improve their students' learning experiences and performance (Trentin, 2009).

Along with the benefits above, cloud computing reduces operating and capital expenses while increasing IT efficiency through server consolidation, improves service delivery and it offers online access to systems and applications over a variety of devices. Implementation of cloud computing technology in higher education is not only extremely advantageous, but also a necessity to compete against other institutions to provide the latest technologies and solutions to their students.

II. Challenges of Cloud Computing in Distance Learning

Even though cloud computing technologies have thrived in mainstream applications and both promise and deliver multiple advantages in the educational sector, educational institutions

still remain reluctant to apply cloud based systems to enterprise uses on campus (Sheard, 2010) because of security, privacy and other concerns. In greater detail, the challenges of implementing cloud computing on a widespread scale, such as in distance learning, include:

1. **Security concerns:** Numerous institutes are concerned regarding whether the data stored on these cloud platforms is safe, and able to be backed up and restored easily (Jensen et al., 2009).
2. **Privacy concerns:** Institutions are skeptical regarding the privacy of their data in the cloud, where it could be vulnerable to exploitation and hacking.
3. **Bandwidth concerns/limitations:** Since E-learning cloud computing services are internet based, all application data must be transported on a remote network. Such data traffic requires a very high bandwidth requirement that multiple institutions do not obtain. The insufficiency of current IT infrastructure in higher education institutes makes it difficult to deploy distance learning methods.
4. **Educational methods and forms:** Distance learning challenges traditional educational forms and methods. While these advancements in the education experience is highly beneficial for students, teachers may require extra training to integrate such technology to their classes.

III. Implementation of Cloud Computing in Distance Learning

"A vital concern shared by practitioners, learners and institutes in implementing cloud computing services is how well they integrate into their systems"(Ali, A., Bajpeye, A., & Srivastava, A. K., 2015, p. 52). In order for universities to integrate cloud computing to their systems, they must use one of its three service models:

1. **Software as a Service (SaaS):** This allows the consumer to use the provider's applications running on a cloud infrastructure. These applications are accessible through thin client interfaces (eg. web browsers for web-based emails) or the program interface itself. The consumer cannot manage or control the underlying cloud infrastructure

(including network, servers, storage, operating systems and full individual application capabilities)

2. **Platform as a Service (PaaS):** The capability provided to the consumer using this model is to deploy consumer created or acquired applications onto cloud infrastructure. However, the consumer still does not have control over underlying cloud infrastructure.
3. **Infrastructure as a Service (IaaS):** Using this model, the consumer is able to provision processing, storage, networks and other fundamental computing resources where software is deployable. The consumer does not have control over the underlying cloud infrastructure but is able to control OS, storage and deployed applications.

In order for educational institutes to implement cloud computing for applications such as distance learning, a business analysis must be conducted, a business case must be built and a cloud service provider (CSP) must be sourced to plan and implement the solution. The correct cloud solution must be chosen that fits the structure of instructional activities for the institution's distance learning program.

IV. Conclusion

Cloud computing is changing the way IT resources are utilized and consumed (Armbrust et al., 2010). While concerns are raised regarding IT challenges, data management, security and privacy- with strategic planning, cyber-security and correct implementation of cloud models, it is very feasible to minimize these concerns. Doing such will pave the way for numerous benefits to not just distance learning, but advancements in higher education as a whole. It will increase the effectiveness and efficiency of teaching through the integration of technology in institutional practices. At the same time, it will drastically cut costs and expenses, as well as reduce workload of IT staff by shifting it to cloud service providers- allowing IT staff to develop DL infrastructure to a greater extent and train, support and assist faculty members rather than spend a large portion of their work time on maintaining conventional IT infrastructures. Overall, cloud computing promises a huge positive impact on distance learning and facilitating students with advanced technology to learn and collaborate.

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