How Can Cloud Computing Bridge the Digital Divide in Sri Lankan Education?

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Abstract

Cloud computing technology is seen by many as the next wave of Information technology for companies, education sectors and governments. In the current financial crisis and being challenged by growing needs, Education institutes, schools are facing problems in providing necessary Information technology (IT) support for educational and research activities. The aim of this research project is to find alternatives to the use of Information technology. Cloud computing can present an easy and inexpensive access to state-of-the-art IT technology, software and applications. The internet-based shared computing system, which is the newest buzzword in the global IT industry, can approach to bridge the digital divide in the education sector. The main purpose of this research is to briefly examine which cloud computing technology services currently employed by education systems in developed countries can be used to help violate the digital divide that currently presents in the education sector in Sri Lanka. This paper illustrates the reasons for the rise of cloud computing in education, its developing definition and models, examples of cloud computing in higher education sector in world today and its potential in the future.

Keywords: Cloud computing, education system, developed countries

1. Introduction

What is Cloud Computing?

Cloud computing is internet based computing where shared servers supply software, infrastructure, and platform devices on a pay-as-you basis. All information that a digitized system has to offer is provided as a service in the cloud computing technology. Users can focus more on their core business processes rather than spending time and gaining knowledge on resources wanted to customize their processes.

According to NIST Composed of five essential characteristics, three service models four deployment Models. Five essential characteristics are on—demand self service, Broad network access that means capabilities are available over the network and accessed through any client platforms, Resource
pooling, the provider’s computing resources are pooled to serve multiple consumers. Rapid elasticity that capabilities can be rapidly and elastically conditioned, in some cases automatically, and measured Service which cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service.

There are four different deployment models of cloud computing. Private cloud, the cloud it may be managed by the organization or a third party and may present on premise off premise. Community cloud, the cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). Public cloud, the cloud infrastructure is made existing to the general public or a large industry group and is owned by an organization advertising cloud services. Hybrid cloud, the cloud infrastructure is a composition of two or more clouds (private, community, or public).

Cloud Models can be segmented into Software as a Service (SaaS), Platform as a service (PaaS) and Infrastructure as a Service (IaaS). Software as a Service, this is typically ending user applications delivered on demand over a network on a pay per use basis. The software requires no client installation, just a browser and network connectivity. Platform as a Service Used by software development companies to run their software products. Infrastructure as a Service is a model in which an organization outsources the equipment used to support operations, including storage, hardware, servers and networking components.[1],[2]

**Cloud computing in education sector.**

The benefits of cloud computing and virtualization are being embraced by many sectors of business and industry and now are being adopted by education sectors. Education in Sri Lanka is seen as the foundation of society which brings economic wealth, social prosperity and political stability. Cloud computing presents many advantages to e-learning by providing the infrastructure, platform and educational services directly through cloud providers and virtualization. There are many of examples using cloud computing for education. Virginia virtual computing lab (VCL) enhance with cloud computing technology and provide students with access to the architectural, geographical, mathematical, research, statistical applications they at any time any location with an Internet broadband connection. The importance of virtual computing lab (VCL) is demonstrated clearly by Virginia saves resources. Software in a virtual lab is used more than software in a physical lab, reducing the peruse cost of each software license and unlike physical computer labs, a virtual lab is available to students 24 hours a day, during every day of the year. [9]

The VCL which began in 2002 by North Carolina State University, with support from IBM, and in 2009 it became available as a free, hardware-agnostic Apache open source project. There are now similar education clouds based on the VCL in California, Georgia, and South Carolina. These are the benefits of using cloud computing specially in higher education Access to scientific, management, technological applications from anywhere in the world. It supports in teaching and in learning, these software's free or pay per use, cloud computing technology is business environment and advanced researches and increased directness of students to new technologies.

Cloud computing is an innovative, it allows for more than the use of textbooks and it is a tool to bridge the digital divide and to solve educational problems which arise in Sri Lanka. For students, cloud computing makes real-time collaboration easy. Online meeting spaces and video chat also make it possible for students to meet and attend classes online. And with assignments that live online and can be accessed anywhere, students can take their learning with them anywhere. All of these things) are made possible through cloud computing and have the potential to transform education as we know it.
Cloud computing allows institutions, business sectors and education sectors to access real time information from anywhere in the world at any time. In the field of education, this is pretty important as it gives the teachers and the learners to continuously update their domain knowledge. Cloud computing allows teachers and learners to access applications and other useful tools free of charge. Cloud computing technology is a new technology for our education sector so it is efficient and also environment friendly. Because cloud computing allows for interconnectivity, students are uncovered to openness. Students are able to experience and feel what is processing in the real world. Educators point to cloud computing as a solution for instructors' obstacles in preparation and development of courses and strengthening curriculum. Which material can be taught and learned using textbooks and chalk boards, it is now gathered and absorbed much more quickly and easily through Internet access, using cloud computing technology in the classroom

Katz et al identify 10 important features of cloud computing in higher education with respect to on-demand SaaS, PaaS, and IaaS:

1. Increasing access to scarce IT expertise and talent.
2. Scaling IT services and resources.
3. Promoting further IT standardization.
4. Accelerating time to market through IT supply bottleneck reductions.
5. Channeling or countering the ad hoc consumerization of enterprise IT services.
6. Facilitating the transparent matching of IT costs, demand and funding.
7. Increasing interoperability between disjoint technologies within and between the institutions.
8. Supporting a model of a 24 x 7 x 365 environment.
9. Enabling the sourcing of cycles and storage powered by renewable energy.
10. Driving down capital and total costs of IT in higher education.

2. Problem Definition

Under this section the research problem is described and provided with the existing knowledge on the topic.

2.1 Background Study

Background study contains the literature review carried out in understanding the research goals. The literature review, community discussions, and interviews with higher education IT community leaders suggest that cloud computing are an important and likely transformational new facility. Many Universities are vitalizing aspects of their IT infrastructures and services, a significant number are experimenting with public cloud offerings (especially student e-mail), and several are considering offering private cloud services. Smaller IT operations are likely to become consumers of cloud services. All agree that the future sourcing environment will be heterogeneous (with much self-operated) and that new infrastructure, services, programs, and supportive requirements will move to the cloud faster than those that have long been operated on premises. In sum, discussants agree that cloud computing is a natural technical progression to a standard- and Internet-based IT architecture that more fully exploits economies of scale. [3]

Software as a Service (SaaS) Cloud Computing in Higher Education
Although Cloud Platform as a Service (PaaS) and Cloud Infrastructure as a Service (IaaS) are relatively new occurrences of cloud computing in the mainstream of higher education, while higher education has made massive strides in the way that programs are delivered and student data is managed, many schools, universities and institutes continue to be overwhelmed by challenges when it comes to hardware and software. Some of the challenges are expensive up-front costs, ongoing maintenance costs, IT complexity, and minimal ability to adapt to changing opportunities, and little to no combination across the organization.

The solution to this problem is Cloud Computing, and specifically, Software as a Service (SaaS). Cloud Computing uses shared hardware resources, software, and data storage that provide information to devices. The “Cloud” has created a virtual infrastructure that facilitates business applications as a service. Also known as Software as a Service (SaaS), these applications help for Higher education sectors Software as a Service (SaaS) models have been popular across industries including in higher education since the mid-1990s. For example, Windows Live Hotmail, Microsoft’s popular email and messaging service Lot of them predicts that by the end of 2012, more than one-third of independent software vendors will be offering their applications as SaaS.

Google and Microsoft have created their own suite of software applications and tools, including email, and have provided them free to institutions of education. Google Apps for Education, a college/university branded Gmail, Calendar, Contacts, and a suite of collaborative tools is offered in addition to Google’s other popular consumer products such as Blogger, Picasa, and YouTube. By 2010, more than 8 million higher education students in the U.S. were using Google Apps Similarly, Microsoft created Live@edu, which is a suite of free Microsoft services and applications including Hotmail. In early 2009, there were more than 3.5 million Live@edu higher education students (Microsoft, 2009). Just two years later, that number more than quadrupled to more than 15 million.

The primary Advantages of a SaaS cloud computing model come in the form of both technology cost savings and greater efficiencies in the areas of hardware, software, maintenance. But it doesn’t end there – SaaS makes numerous other operational and economical benefits as well.

Software as a service can develop a school’s, universities effectiveness and its student support because it conveys high availability, and enable a school to better manage expansion and address new challenges rapidly. Additionally, SaaS joint with open APIs. It presents an opportunity for colleges to integrate generally with other important education and business applications, as well as easily incorporate their own internally developed applications.

Accepting a wide-ranging SaaS solution can not only save time, but schools, institutes can also expect to see greater financial benefits. SaaS allows colleges to reduce their IT spend, redirect savings toward business improvements, and strengthen their financial capability. A SaaS solution often results in a quicker launch and simplifies on-going support; delivering faster time-to-value lower costs and immediate impact ultimately drive bottom line improvements within the school.

Identify risks and Limitation of cloud computing

1. Not all scientific, technical applications run in cloud.
2. Risks related to data protection and security
   A major aim is around the security of data. Transferring data to a third party for hosting in a remote data centre, not under the control of the organization
3. Security and protection of sensitive data
4. Lack of confidence
5. Speed/lack of Internet can affect work methods.
6. Unsolicited advertising
Another risk is that cloud providers will target users with unsolicited email or advertising.

2.2 Problem Statement

Can Cloud Computing Bridge the Digital Divide in Sri Lankan Education sector?

Sri Lanka is a unique developing country in South Asia. Education in Sri Lanka has a long history which dates back two millennia. Sri Lanka consists of digital divide in education sector. The digital divide is the gap between those with regular, effective accesses to digital technologies, in particular the Internet, and those without. The global digital divide is a term often used to describe the gap between more and less economically developed nations like srilanka, there is often an Urban-rural divides. Cloud computing can bridge the digital devisor in sri Lankan education sector. Educational institutes, universities are also beginning to use lower level cloud services for purposes of data storage. Cloud computing, in a nutshell, is a way to provide computer applications to users without the need for those users to purchase, install, or support software on their local computers or servers. Cloud computing provides Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS), meaning not only the software hosted on a remote computer, but data are stored remotely too.

3. Research Objectives and Research Question

This chapter includes the objectives that are to be covered within the span of the research project. These objectives are formed taking into consideration the aforementioned details under the chapter

Education in srilanka needs effective scalable solutions like those provided by cloud computing technology. Cloud based solutions are centralized and delivered services over the internet all over the world. These types of cloud based solutions extensively help for users to enhance the teaching, learning process, and that knowledge constantly updated and provides an environment where knowledge and teaching and learning tools technologies are existing on-demand. Cloud computing solutions are designed for scale and shared across large group of users. Cloud computing can have the best possible in the local context are given the significant gap are in educational standards in the rural and urban segments, Cloud computing against these conditions can bridge the digital divide in education as it would enable the students to access the same kind of educational resources, technologies through the most recent and most suitable internet-based computing system.

This chapter includes the objectives that are to be covered within the span of the research project. In achieving this main goal, there are six main objectives that can be identified. These are mentioned below.[5],[6]

1) Describe what cloud computing is and its variations from a technical perspective.

2) Describe the benefits of cloud computing to an education sector.
3) Describe the factors that enable success with cloud computing and education.

4) Successfully manage the risks associated with cloud computing.

5) Describe how Cloud Computing Bridge the Digital Divide?

6) How SaaS and Cloud Computing are Transforming Education

Research Question

- Can Cloud Computing Bridge the Digital Divide in Sri Lankan education sector?

These are the problems arise in Sri Lanka such as lack of reliable infrastructure, internet connectivity is still not available in large parts of poor regions, lack of investments in basic network infrastructure and broadband technology. Poverty, many cannot pay for even the cheaper computing devices. Most people in poor regions need some acquaintance with the most basics of computing. Therefore it will require significant training to get them to the point where they can incorporate the concept of cloud computing in their education.

- In achieving this main goal, there are some researches questions arise. These are mentioned below.

- Is there any possibility to come up with cloud computing technology in Sri Lankan education sector?

- The Challenges of Cloud Computing in Sri Lankan Education sector

Cloud computing has been universally recognized as a critical component in the field of education. This is more in the education sector where more advanced tools are necessary for data sharing, teaching, and protection, as well as for advanced instruction.

First, let us briefly discuss how cloud computing becomes useful as an ‘infrastructure.’ Basically, the cloud can be used as a digital place where data, even servers, can be stored and protected.

4. Methodology

The research is based on a cloud computing. Cloud computing is a tool, not a strategy. As mentioned in previous chapters, the research main objectives. The methodology that is expected to be followed in achieving those objectives listed below. Based on the knowledge available, the methodology in completing this research formed. There can be five steps...
identified in the process of cloud computing in Education sector.[7]

Step 1

Developing the knowledge base about Cloud Computing and future trends;

The first step consists in developing the knowledge about cloud computing by participating seminars, conference based on cloud computing. Study how cloud computing functions in different organization and universities. Identify benefits and risks, policies and the best usage practices of cloud computing.

Step 2

Evaluate the present situation of education sector from the point of view of information technology

Analyze university’s present IT needs, structure, and capacity utilization. In a cloud computing environment, where resources can be added based on needs and demand, In looking at data center utilization, it will be essential to look at what resources are used all the time and are necessary for day-to-day operations to establish a baseline for internally-hosted operations

Identify the simplified structure of the main users of IT services in a University. Analyse how can we transfer those previous technologies in to cloud computing. After examine those issues can enumerate a few of the most used Solutions in universities, grouped according to the three supply models (SaaS, IaaS, PaaS)

Then pick one area even one specific project in education sector

Step 3

Choosing the Cloud Computing solution.

Next step is to identifying the data and applications, functions and main processes within the Education sector. These may be grouped according to the three large categories of activities from the university: teaching, research and administrative.

Step 4

Implement the cloud computing solution

The solution implementation may be done in iterative phases, through a continuous transition of the data, services and processes towards cloud, with the eventual return from cloud to operations internally hosted. It is performed based on some continuous evaluations of the cloud technology benefits upon the university. At the same time, implementation supposes establishing a flexible program of risk management (for treating the informational risks in continuous growth), testing the solution performance and implementation management.

5. Working Plan and Time Schedule

As mentioned in the methodology, there are five steps involved in the research.

1. Literature survey
2. Experiments
3. Study cloud computing is and its variations from a technical perspective.
4. Gather Data
5. Analyze data
6. Evaluate the present situation of education sector from the point of view of information technology
7. Then pick one area even one specific project in education sector
9. Implement the cloud computing solution

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<th>Task</th>
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<tr>
<td>Literature survey</td>
<td>Study cloud computing is and its variations from a technical perspective</td>
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<td>Study the factors that enable success with cloud computing and education.</td>
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<td>Study how Cloud Computing Bridge the Digital Divide?</td>
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<td>How SaaS and Cloud Computing are Transforming Education</td>
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<td>Gather Data</td>
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<td>Analyze data</td>
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<td>Select one area even one specific project in education sector</td>
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