

CLOUD COMPUTING: A VIEW ON VIRTUAL COMPUTING LABS

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Abstract

Cloud computing is a kind of computing which is highly scalable and use virtualized resources that can be shared by the users. Cloud technology trends (virtualization) will likely have a significant impact on teaching and learning environment. This paper details the concept of cloud computing using a Virtual Computing Lab (VCL). We focus on a cloud computing implementation in higher education, the VCL concept, the benefits of using VCL in lab and finally we discuss on challenges within a higher learning institution.

1. Introduction

The cloud computing is increasing in popularity nowadays. It emerged about mid-2007 to encapsulate a number of trends that had started many years before, but were all connected by a common characteristic which are accessing remote computing power over a network. today's "cloud" platforms such as "Microsoft" and "google" are providing free services to students and staff at educational institutions which include email, contact lists, calendars, document storage, creation and sharing documents and the ability to create websites google, through their google apps products, has made one element of that transition to cloud computing clear where the web browser is the next desktop and the data will reside in cyberspace. Web-based email started this trend a decade and a half ago and now the trend seems to have reached early maturity.

The National Institutes of Standards and Technology (NIST) defines cloud computing as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Cloud providers may offer tremendous applications to their customers. these applications may vary widely to provide many services in education, government, banking and healthcare. the hardware and systems software in the data centers that deliver those services is called a cloud [1]. so, a cloud can be considered to be a collection of hardware, software and other resources that can be accessed over the internet, and used to assemble a solution on demand and provide a set of services back to the requester.

In this study, researcher try to understand in better the implementation of cloud computing focusing on virtual computing lab because researcher is going to propose a solution for the new Kolej Universiti Insaniah's campus. Kolej Universiti Insaniah (KUIN) has limited resources yet they need to adequately prepare their students with appropriate information technology skills. This requirement mandates the installation and maintenance of sufficient computer facilities for the faculty and staff. The minimum requirements of such facilities include the installation of diverse operating systems, upgrades, patches and new software installs to support instruction. so, the planning is to use the 'virtual computing lab' concept. Additionally, a smaller number of technical staff must still disseminate licensed software to the labs and faculty as well as manage authorized access to software and administrative access to systems. These activities can significantly pressure the technical staff and lead to delays in responding to instructor requests.

In order to be competitive, universities must keep pace with changes in global economy and in technology. this paper highlights a realistic perspective of the possibilities, challenges of cloud computing especially virtual computing lab that kuin will need to look before implementing it in the computer laboratory for the new campus.

2. Cloud Computing in Higher Education

One of the most interesting applications of cloud computing is educational cloud [2,3,4,5]. It is considered one approach to deal with the challenging and frustrating budget cuts that many colleges and universities are dealing with, reports non-profit EDUCAUSE. The potential and efficiency of using Cloud Computing in higher education has been recognized by many universities for example the University of California, Washington State University's School of Electrical Engineering and Computer Science, higher education institutions from UK, Africa [6], U.S and others.

Higher education institutions today are considering substituting to cloud-based service because they promise a higher accessibility, availability and efficiency. For academician, cloud computing lets students, faculty, staff, administrators, and other campus users access file storage, e-mail, databases, and other university applications anywhere, on-demand. Institutions will gain the benefits of cloud computing in varying degrees contingent upon their level of deployment and extent of service models. As institutions become further entrenched and engaged in cloud computing configurations, they will be able to realize greater advantages, such as increasing access to scarce IT expertise and talent, promoting further IT standardization, the transparent matching of IT costs, demand and funding, and increasing interoperability between disjoint technologies within and between institutions.

There are various cloud computing platforms for education in use nowadays. For example, [6] has revealed how institutions and universities are likely to embrace cloud computing as many of them are bound to suffer from under-funding due to the global economic crisis. Another one is [7] has proposed Seattle; an educational networking, free, portable, and lightweight platform using donated cloud computing. Seattle allows students to learn the concepts of networking and distributed systems on computers spread through the Internet. Another example, where a university student taking a college math course could access a cloud from his or her door room, to obtain a physical or virtual server (with the necessary storage) and a copy of Maple or MATLAB software running on it to use for homework or a class project. Likewise, an elementary school teacher could access the same cloud to request one virtual machine for each of his or her students running Mathmedia software, as part of his or her classroom instructional activities [8].

In general, cloud service providers tend to offer services that can be grouped mostly into these categories.

- Infrastructure as a Service ("IaaS") where some service providers offer cloud-based storage, much the same as a campus storage area network (SAN)
- Computing as a Service ("CaaS") is sometimes included in IaaS, CaaS service providers offer access to raw computing power on virtual servers, such as Amazon's EC2 service
- Platform as a Service ("PaaS") where certain providers are opening up application platforms to allow customers to build their own applications using that platform's underlying operating system(s), data models and databases, pre-built application components and interfaces
- Software as a Service ("SaaS") is that application service providers have been hosting applications for quite some time, but the difference with SaaS in the cloud is that the servers hosting the applications are also virtualized.

In conclusion educational cloud computing environment offers a wide range of services in application, platform, and infrastructure levels to students, faculty, researchers, and academic staff.

3. Virtual Computing Lab

Virtual Computing Lab (VCL) [9] is an open source, on demand, remote access system that dynamically provisions computing resources to end users. The system was initially developed at North Carolina State University (NCSU) and became an Apache incubator project in 2008 [10]. Virtual computing resolves student challenges associated with physical labs such as limited lab hours, limited seats during times of high demand, travel to metropolitan campuses in heavy traffic, individual safety during evening and early morning hours, and the availability of complex tools for distance learners.

The concept of virtualization could eliminate the need to maintain and manage large, expensive system across campuses by giving universities a scalable, cost effective solution to support learning, assessment and development. As a result, universities gain the freedom to test and refine new courses without having to maintain physical labs or costly upgrade equipment.

Essentially, a Virtual Computing Lab (VCL) provides a “cloud-computing” direction for provision of academic tools. A virtual computer lab takes programs running on university hardware and beams the images to any computer desktop across the internet, giving students the ability to create and save work as though the programs were running on their own hard drives. It is a model popularized by Citrix, and has been popularized within higher education by several institutions such as North Carolina State University, California State University System, George Mason University and Georgia State University. By using cloud computing to support a virtual computing lab, North Carolina State University was able to save software licensing costs and reduce the campus IT staff from 15 to 3 employees [11]. Art Gloster, vice president for information services at Bryant University, reported that the school saved an estimated \$35,000 in the four years since implementing virtualization technology [12]. Many students begin using cloud-based technologies in higher institutions due to the convenience, flexibility and ubiquitous access needed for their active, mobile and always connected lifestyles [13].

Most of Cloud computing platform is based on virtualized environments. In a virtualized Cloud computing lab, there are four major parts: software and hardware platforms provided from real and virtualized servers (PaaS resources); resource management node; database servers and users who access resources through Internet or Intranet. Generally speaking, above mentioned platforms and users can all be called resources in the Cloud.

VCL is interesting because the software’s performance depends on the strength of the student’s Internet connection as opposed to the processing power of their computer, so even students with older computers can use advanced software without difficulty. VCL provides access to resources that may not be available within a local campus, either because those resources were too computationally intensive, were based on applications too complex to install and maintain, or perhaps even inaccessible due to local licensing.

By using the cloud to “virtualize” applications like the statistical analysis package SPSS or a 3D computer graphic design application like Autodesk Maya, and in coordination with partner campuses or vendors who can provide back-end application support, virtual computing have the capability to open up a wealth of tools and capabilities that are often difficult to run locally. 3D rendering that might cripple even an impressive workstation can be run in the cloud from a netbook, with the campus only billed for the CPU cycles consumed.

Clearly then, VCL will enhance student learning in a way that benefits not only the learners, but also the universities that provided them with the innovative, translatable education designed to meet real-world expectations.

4. Benefits of VCL

In universities, users are typically students and faculties. Generally, cloud computing systems serving these users within a university environment must at least provide the capabilities such as to provide services and support to a wide range of users and provide a wide-range of course materials and academic support tools to instructors, teachers, professors, and other educators and also university staff.

In VCL, the maintenance of the infrastructure, whether the hardware or software is simplified, thus, less headaches for the IT team. Also applications that are quite storage extensive are more easier to use in the cloud environment compared to the same when used by the organization by its own. Also at the user level, what you mostly need is a simple web browser with internet connectivity.

The benefit of the VCL to students is increased accessibility of computing resources. Many students do not have access to software used in specialized classes and others lack sufficiently powerful hardware or the administrative sophistication to install or run needed applications. The VCL provides a set of preconfigured software resources, customized to specific educational activities, and available to any student with a Web browser and Internet connection.

Other than that, VCL also may increase manageability. Instead of installing operating system software, application software, and configuring an existing machine, a previously configured virtual machine could be distributed. An exercise that requires several hours of setup can be configured once, then distributed. Additionally, if system resources are capable enough, several virtual machines can run simultaneously, connected through a virtual network connection. While not all attacks can be modeled using this environment, the ability to run a demonstration in a normal lab, and indeed even a student's home computer without risk to the computer itself makes this an excellent configuration options for security lab development.

In terms of portability, users can login to their desktops from anywhere on the internet or from any workstation in the department and the desktop environment stays constant no matter where it is accessed from. Part of that, a virtual desktop can be viewed by numerous users simultaneously, which can be an inexpensive means of telecommunication.

VCL is also a cost-effective implementation of cloud computing. VCL is different from the traditional physical remote lab systems in that it provides dynamic scheduling service and image provision. Thus, the lab resources can be shared more effectively and efficiently. Instead of having to go to the physical computer labs, the faculty and students can access applications and/or custom virtual environments remotely anytime and anywhere.

We can thus conclude that a VCL is an open-source Web based system used to dynamically provision and broker remote access to a dedicated computer environment for a user. VCL cloud ensures significant savings when compared to the cost of physical infrastructure procurement and maintenance for both the user institution as well as the entire higher learning community.

5. Challenges

Cloud computing for sure is very promising, however, it has to go through several maturity and stability curves, before it can be consumed the way it's being sold today.

The challenges that will constrain higher education's adoption of cloud computing relate to trust, confidence, and surety. [14] points out, "building an IT organization's confidence in a solution requires a combination of consistent performance, verifiable results, service guarantees, transparency, and plans for contingencies." Clearly most cloud services do not have the track record on which one can build the necessary trust to shift existing services without either great deliberation or a very compelling benefit.

Security is a main area of concern for most companies that host their own services and in fact it is one of the top reasons businesses hindering cloud computing. A lot of this apprehension is due to trust and control because, once a business moves its data outside the corporate data-center walls, it has no longer in the hands of company employees. Well-known security issues such as tampering or leakage of sensitive data on the cloud, loss of privacy and the unauthorized use of the data by cloud providers pose serious threats to organization's data and software. For example, hackers are planning to use Cloud to organize botnet as Cloud often provides more reliable infrastructure services at a relatively cheaper price for them to start an attack [15].

Privacy is another factor. As these data are accessed from any location, it's possible the client's privacy could be compromised. One way to solve this issue is the use of proper authentication techniques. Another solution is to provide with an authorization so that each user can access only the data and applications relevant to their job.

6. Conclusion

Cloud computing as an exciting development is a significant alternative today's educational perspective. Virtual Computing Laboratory (VCL) is an open source implementation of a secure production-level on demand utility computing and services oriented technology for access to solutions based on virtualized resources.

In this paper cloud solution which is the Virtual Computing Lab and their benefits and challenges were studied briefly. The benefits include management and provisioning that can be as centralized or as distributed as one wishes, considerably increased utilization of the resource and thus reduced cost of service delivery, reduced information technology overhead on institutions that may not have appropriate resident personnel for construction and maintenance of very complex information technology services and provision to end-users of a very broad palette of computational services on-demand - thus levelling the field at an affordable cost.

There are of course some challenges too. The cloud computing services needed to deliver the majority of IT services needed by customers do not yet exist. There are still problems and constraints which relate to trust, confidence, privacy and some security issues. Cloud computing can be the technology infrastructure that can be revolutionize education if it is correctly and safely implemented.

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