A smart Architectural concept for making of a University Education System using Cloud Computing Paradigm

Ramendu Bikash Guin[1], Sayan Chakrabarti[1], Chinmoy Tarafdar[1], Sourav Mandal[1], Sourav Banerjee[1], Utpal Biswas[2]

[1]Department of Computer Science and Engineering
Kalyani Government Engineering College
Kalyani , Nadia, West Bengal, Pin : 741235, India
Email: {ramenduguin, sayanchakrabarti7, chinmoykgec, souravmandalhlr, contact200683} @gmail.com

[2]Department of Computer Science and Engineering,
University of Kalyani,
Kalyani, Nadia, West Bengal, Pin : 741235, India
Email: utpal01in@yahoo.com

Abstract

Universities have a great importance to every nations, their significance cannot be minimized. Generating of a bright students and future recourses are the main purpose of the universities.. Almost in every country, governments spend huge amount of budget to upgrade the condition of university in every year either by constructing new ones or employ good faculties at any cost. However, in spite of this good effort by the governments, sometimes the main purpose go in vein, i.e., it is seen often that only the amount gets spent, but no benefit at all. In this paper, we will disuses the causes of the aforesaid problems and give a model architecture of university education system using cloud computing. Making of a private cloud to each university and covering all the colleges, institutions under that university's private-cloud would be a nice and cost-saving endeavor. Using our proposed model, not only the government will be benefitted having spent comparatively lower cost to universities, but also the quality of education system would be raised undoubtedly to some extent. We are also giving the comparison to the existing and our proposed model and thus showing that proposed model would be the best scenario at this critical time.

Keywords: *Cloud computing, key benefits, model architecture.*

1. Introduction

Cloud computing is a distributed technology which delivers hosted services over the internet to provide easy access to IT services. It aims to power the next generation data centers and enables application service providers to lease data center capabilities for deploying applications depending on user quality of service [1](QoS) requirements. Cloud applications have different composition, configuration, and deployment requirements. Cloud computing is a model for enabling ubiquitous, 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. In the recent years cloud computing is considered as the most ubiquitous technology for its flexibility and deploying and scaling applications which is derived gradually from the perception of virtualization[2], service oriented architecture [3] ,distributed composition, and enterprise IT administration [4].It has three type of delivery model [5]:software-as-a-service(SaaS) ,platform-as-a-service(PaaS) and Infrastructure-as-a-service(IaaS) [6]each of which does a definite purpose and supports different products for organization and individuals throughout the world [7]. Cloud computing has four deployment model, as public cloud where external organizations provide the infrastructure and management required to implement the cloud and dramatically simplify implementation and are typically billed based on usage, private cloud where the infrastructure for implementing the cloud is controlled completely by the enterprise and maintains all corporate data in resources under the control of the legal and contractual umbrella of the organization, community cloud where cloud is controlled and used by a group of organizations that have shared interests, such as specific security requirements or a common mission and the members of the community share access to the data and applications in the cloud, and the last one is hybrid cloud where public and private cloud are merged to fulfill a unified solution. Figure 1 is giving us an overall scenario of our proposed

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educational model architecture. In this paper everything is discussed in the light of private cloud, i.e. each university has their own private cloud and

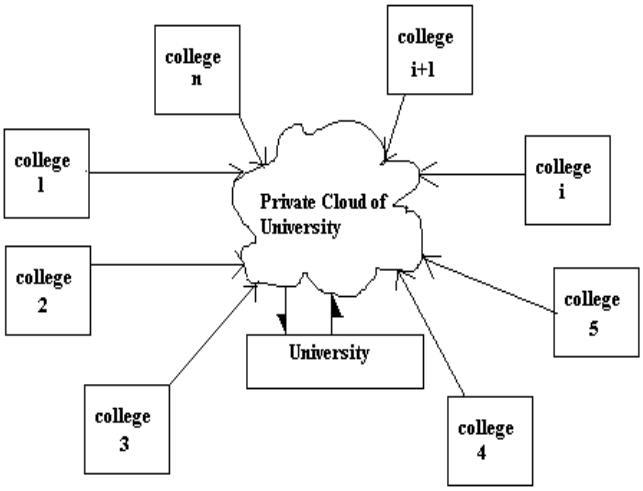

Fig 1: University private cloud and connecting colleges

Only the respective users can access the corresponding cloud resources. In section 2 background aspects which motivate us to propose this new model are discussed, in section 3our proposed architectural model is enlightened, in section 4 comparative study with existing system is described , in section5 conclusion and future work are referenced.

2. Background Aspects

University system has a great importance in every nation. Generally a university is a distributed system and has many college institutions at different geographic locations under a university. Different subjects are taught in different colleges. Every government allocates a huge amount of budget on universities to have a bright, skilled future manpower. Undoubtedly it is a good effort by the governments but in many cases the ambition of the governments does not come into existence at the full extent. Because as university is a distributed system, it is not an easy matter to control each colleges under it to maintain good quality all time. And it is true that in a distributed system, flaws can easily enter the system .Rather than centralized systems are less prone to this problem. To make each college good, different educational resources i.e. hardware, software, study materials etc are necessary. And these cause huge expenses. Besides, it is not also possible every time to employ good quality of faculties to each institutions .Thus the unfortunate students under those weak faculty members are deprived to gain exact knowledge, their many curious question regarding related topics many time remain unanswered, unexplained. In spite of this , to raise the quality of institutions, too much resources including books, computers, softwares are bought to aid the students . But only few instances of the softwares are being used most of the times, so many of them remain unused, but for them, authority had spent large amount of money. In addition this is not an easy matter to implement the governmental system rule educational course curriculum due to lack of communication. As cloud computing technology binds the several distributed recourses under a single authority control, so we suggest that cloud computing would be the best to overhaul the university education system. More elaborately we can say, that if a private cloud can be constructed covering a university and its colleges, then the aforesaid problems can be minimizes greatly.

3. Proposed Architectural Model

Our proposed architecture regarding this incorporates making of private cloud technology to cover university and its colleges. Private cloud [8] is necessary as different university may deploy their own private clouds and it would be more secure and less prone to be hacked. So public cloud concept will not serve well in our proposed university education model. It includes cloud servers, local servers and users' computers. Generally huge amount of cloud servers are necessary to set up private cloud server. This servers must be stored at the university and be controlled by the administrators. Different colleges possess many computers for laboratory, research room, libraries etc. with varieties of softwares loaded in the corresponding hard disks. But hardly few of them are used concurrently or frequently. So most of them remain unused most of the times. Besides, there are some licensed softwares which needs purchase to work properly. But to install that software on many computers, so pirated copies are the only ray of hope. But, actually performance degrades or does not reach cent present due to counterfeiting. Besides, use of pirated copy is dangerous and is considered to serious crime. If the college authority buys multiple copies of the same licensed softwares then this not only include huge expense but also most of them are remained unused most of the time. If this had not been happened, then that huge amount of money would have been used in others development issues.

Here our proposed model says that software both free, open source, and licensed software must be installed to the cloud servers at the university. Software should be installed as single copy, there is no need to install multiple copy of same software, causing saving of money. Job scheduling system of cloud computing [9] will control the same type of job to the respective cloud servers. The cloud servers are referred to as node controller and deploy hypervisors [10] to provide virtualization [11] techniques.

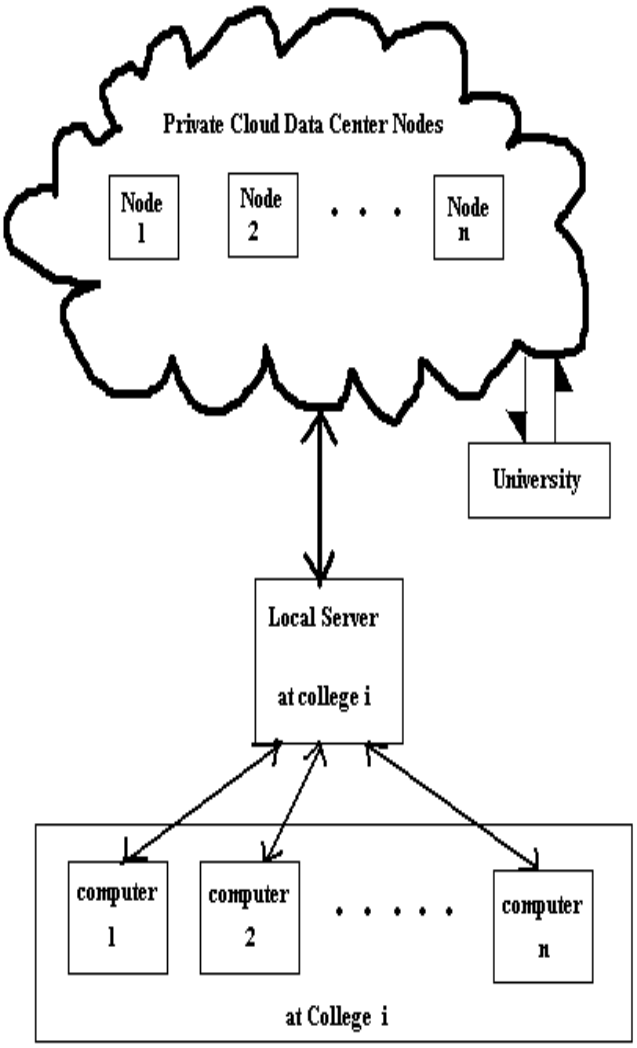

Fig 2: Private cloud model between the university & one of its colleges

Each registered colleges of the university must have a local server in their own premises. Figure 2 describes the detailed view of our proposed model elaborating only one college view and private cloud. Local servers will act as a cluster controller containing walrus, storage controllers, and session controllers. It should have two Ethernet ports: eth 0 and eth1. Port eth1 will be solely used for private cloud and the IP address of that local server should be the gateway of the cloud node controllers. Port eth0 will be used publicly, i.e to connect the local server to outside world, to communicate the college computers. Local server is connected to the college inside computers i.e. college computers only communicate to the private cloud servers only through the local servers.

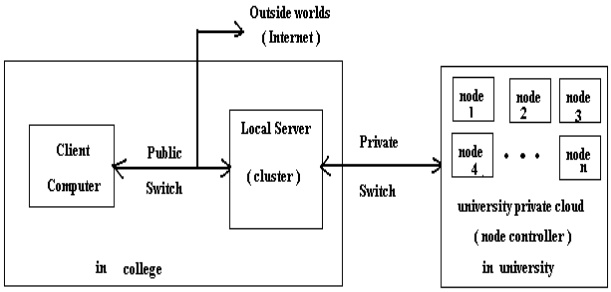

Fig 3: Local cluster and private-cloud node-controller model

By the public switch the college computers are connected to the local server as well as to the outside worlds. Local servers are connected to the university cloud only by the private switch. Local servers here acts as the middleware [12] of the cloud .It distributes the workloads by the users mainly using honey bee algorithm, active clustering and biased random sampling algorithms [13]And send user jobs to the exact servers. Additionally, local-servers resolve the primary authentication and access control of users to the cloud. Each user willing to use cloud resources first has to authenticate him as a registered user of the private cloud. This verification is done by the Local server also. The local servers and college computers should only have minimum amount of random access memory because all the users' calculations will be done remotely by the cloud servers, so high amount of random access memory is essential to the cloud servers only, not in the user computers. Figure 3 signifies the position of cluster and node controller of the private cloud .The cloud servers also will provide cloud operating system as platform-as-a-service features to the users. The benefits are described below:

3.1 Low Amount of Random Access Memory needed for users' Computers

As stated above, the main calculated be it mathematical of logical operation will be done by cloud servers, so users computers do not need to have high amount of primary memory. The main job of users will be only to open browsers to connect to the private cloud servers, and low primary memory

would be enough to accomplish this simple job. This also reduces cost as primary memory is very expensive.

3.2 Low amount of Hard Disks needed for users' Computers

As the private cloud will also provide cloud operating system, so users will store their secret and private personal data by uploading them to the virtual hard drives of the cloud operating systems. Besides, as there is no software loading to the users computers, so medium amount of hard disks will be more than enough and simultaneously reduce the cost.

3.3 Free Operating systems to users' Computers

As everything will be done by the cloud servers, so only free and open source operating system is needed to be installed on the users' computers. Users will open their browser to be connected to the private cloud servers and performs every types of their job or they may connect themselves with the Internet through the browser. Here, Software-as-a-Service (SaaS), one of cloud computing features, would server the user's jobs.

3.4 Access to High Quality Study Materials

High quality of study material, original copy of e-books, lectures videos of reputed institutions across the world can be placed to the cloud servers at the university to provide any time access to the resources, thus qualifying the learning system. Thus students and teachers both will be benefitted.

3.5 Accessing to the Cloud Operating System Easily

University cloud not only provides softwares, eStudy materials to the clients, but also provides cloud operating systems to each user. Users after giving proper username and passwords will be allowed to access that operating system through their browser, and can upload their secured data by uploading to the cloud virtual hard drives. Thus the users' data will remain secured and safe.

4. Comparative study and Analysis

Now with the help of above benefits, we will explain that our proposed architecture is comparatively stronger and integrated than the existing education system in the light of following cases.

4.1 Secured User Data and Easy Availability

In colleges students do varieties of projects, works and thus need related data for that purpose. The users have the responsibility to store them for future reference, but hard disc failure becomes the villain in their purpose. Using cloud operating system and virtual hard drives, storing different users' data are made possible and easy, secured.

4.2 Good back up of Knowledge

In some cases, where there is not the right scope of employing proper faculty to regarding subjects, then e-Study materials offered by the private cloud may be giving a ray of hope to the students .

4.3 Economically Affordable

Due to non-installing expensive softwares, study material to every college, save an incredible amount of money .These only need to be installed to the cloud servers. Moreover, delivering question papers to all colleges via cloud network reduces transport and security cost of question papers. After getting, the teacher-in-charge of examination print them and conduct examinations.

4.4 Correspondence Course and e-Learning

University private cloud may provide the willing registered persons correspondence courses in the same way and giving him/her scope to access , download reputed, high quality study materials at low cost.

4.5 Against Piracy

As licensed copies of softwares, eBooks need to be installed only at the university servers in single copies and the college users use free, open operating systems like Linux, there might be a venture against piracy and theft of intellectual properties in this way.

5. Conclusion and future Work

The primary goal of our proposed model is utilizing the limited resources in a most efficient and cost-saving way. Since it is seen that the most of the

resources remain unused for most of the time, so we have got influence this architectural model. Moreover we could find some serious flaws in the management of resources as there is no central observation of resources for individual institute. Besides, the widespread use of pirated software can be controlled using our proposed architecture. Now our next work will be to implement this model on simulator just to see the performance gain. Then we may suggest that this type of system might be incorporated form the grass root level i.e. developing private cloud for primary education systems, secondary or ten plus system, higher secondary or ten plus two education systems. Though, initial set up of private clouds in those cases would cause high cost (buying of many computers initially would be costly), but it is assured that ultimate goal of a nation will be qualified with saving a high amount of money.

References

[1] "Service Performance and Analysis in Cloud Computing" by Kaiqi Xiong, Harry Perros 978-0-7695-3708-5/09 $25.00 © 2009 IEEE page- 693-700

[2] "Virtual Infrastructure Management in Private and Hybrid Clouds" by Borja Sotomayor ,Rubén S. Montero and Ignacio M. Llorente ,Ian Foster 1089-7801/09/$26.00 © 2009 IEEE

[3] "Research on Distributed Architecture Based on SOA" by Hongqi Li , Zhuang Wu 978-0-7695-3522-7/09 $25.00 © 2009 IEEE 670-674

[4] M. Armbrust, A. Fox, R. Griffith, A. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, M. Zaharia. Above the Clouds: "A Berkeley View of Cloud computing". Technical Report No. UCB/EECS-2009-28,University of California at Berkley, USA, Feb. 10, 2009

[5] "Toward a Unified Ontology of Cloud Computing" by Lamia Youseff, Maria Butrico, Dilma Da Silva

[6] "An Approach to a Cloud Computing Network" by Francesco Maria Aymerich, Gianni Fenu1, Simone Surcis 978-1-4244-2624-9/08/$25.00 ©2008 IEEE 113 page 113-118

[7] "Cloud Computing and Services Platform Construction of Telecom Operator" by Xu Lei, Xin Zhe, Ma Shaowu, Tang Xiongyan. Broadband Network & Multimedia Technology, 2009. IC-BNMT '09. 2nd IEEE International Conference on Digital Object Identifier, pp. 864 – 867.

[8]" Comparing Public, Private, and Hybrid Cloud Computing Options" By Judith Hurwitz, Robin Bloor, Marcia Kaufman, and Fern Halper.

[9]" An Optimistic Differentiated Service Job Scheduling System for Cloud Computing Service Users and Providers" by *Luqun Li* 2009 Third International Conference on Multimedia and Ubiquitous Engineering page-295-299

[10] "Windows server virtualization and The Windows hypervisor" by Brandon Bekar

[11] Virtualization Basics from Internet

[12] "MIDDLEWARE" by David E. Bakken2

[13] "A Comparative Study into Distributed Load Balancing Algorithms for Cloud Computing" by Martin Randles, David Lamb, A. Taleb-Bendiab 2010 IEEE 24th International Conference on Advanced Information Networking and Applications Workshops page 551-556