Benefits of Cloud Computing as an ICT Tool in Distance Education

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Abstract- The adaptation of distance education by several University change the education scenario of India. With the help of this system it becomes much easier to provide education to the people from every corner of the world, where ICT plays a vital role in providing distance education. The increasing demand for ICT makes cloud computing an indispensable solution for many distance learning organization. Cloud Computing provided virtual resources and several other resources on-demand or pay per use basis. In this paper we try to suggest how cloud computing can be used as one of the ICT tool in distance learning education, which will have several benefits.

Keywords—ICT, Cloud Computing, SAAS, PAAS, IAAS

I. INTRODUCTION

ICT stands for Information and Communication Technology. ICT is a set of miscellaneous technological tools and diverse resources which are used to communicate, to create, share, store and manages information digitally. It comprises of Personal Computer, Laptop, mobile, the internet and other several broadcasting technologies.

ICT provides any time anywhere access to reliable information. ICT has several tools but in recent times Cloud Computing is coming up to be a more emerging tool with every passing day. Now a days ICT is more than just a technology, on several fields suchas education, health, business etc. it is creating huge influence. ICT increases the efficacy of these fields at all level and becoming the basic building blocks for these fields. The most important component of our life is education, because it equips us with all that is required to fulfil our dream. Distance education is one of the promising model of education, where physical presence of learner in the institute or University is not always necessary. In this mode of education ICT plays a vital role. It has huge influence on distance education with the help of several techniques, among these video conferencing and telecollaboration are two promising techniques. Video conferencing not only involve audio but also moving image i.e. video. With the help of this technique educator can give lecture online from remote place. The second technique is telecollaboration, whichis an online learning method where web based application such as email, real-time chat, web conferencing etc. link learner to teacher or educator. However the ICT infrastructure become the most essential tool for distance education but due to budgetary constraint it become more difficult to make ICT infrastructure available to all learner [1]. Therefore Cloud computing can be used as an ICT tools for distance education. Cloud computing is becoming an attractive tools due to its scalability and efficiency [2]. Researchers devote more attention on it and its application.

II. CLOUD COMPUTING

Cloud computing is a network based computing model mainly based on internet. It is a modern technique of computing where several resources such as virtual machine, storage, several software etc. Can be provided namicallyviainterneton on-demand or pay per use basis. Cloud computing minimize the cost of buying these resources. Users can rent these resources from cloud service provider whenever they required. Users are also free from the burden of updating the software, because cloud service provider are concentrated on updating these software. Users can enjoy the latest software at minimum cost. This computing technology allow much more efficient computing and also allow users to use several application without installation. Cloud Computing offer different level of services [3], those are

A. Infrastructure As a Service(IaaS)

This level of service provide affordable, scalable and efficient infrastructure such as virtual machine, different server, disk storage etc. on demand or pay per used basis to user to perform their necessary task. Any user can access resource any time from remote location. Amazon Web Service mainly offersIAAS.

B. Platform As a Service(PaaS)

This level of service offer platform to the users to per- form several task. It offer platform like an

operating system, database, middleware and an environment to the developer on which they can create and deploy their application atminimum cost via internet. PaaS provide all the necessary resources required to build applications and services from internet, without having to download or install the software. PaaS generally include application design, development, testing and hosting. PaaS also help in the creation of user interface which is normally based on HTML or Java Script. Google App engine is an example of Platform as a Service which provides a scalable and secure environment for developing several web applications.

C. Software As a Service(SaaS)

It is a software distribution model where application are hostedbyvendorsorserviceproviderandmadeavailabl etoall people over a network on an on demand or pay per cyclebasis. Here we do not have to do any development or programming, but we may need to configure the software. A SaaS provider typically host and manages a given application in their own data center and makes it available to multiple customer over the network. End user can access different services provided by this layer through web portals. For this reason cloud user are increases day by day. Saleforce.com, Google mail, Google Docs are example of SaaS.

Cloudcomputingareimplementedunderseveralde ploymentmodel[5] such as Public Cloud, Private Cloud, Hybrid Cloud and CommunityCloud.

Public Cloud is generally used by general public. Public cloudsareprovidedbycloudserviceprovideroverthein ternet.These clouds are generally away from customerpremises.In this environment different services are provided on pay per use basis. Public clouds are broadly used in development and management of enterprise application at minimum cost.
Followingaresomecloudproviderwhoprovidespubli cclouds are Google, Amazon, and Microsoft etc.

Private Cloud are restricted within the private network i.e. within the boundaries of an organization. These clouds are typically designed and managed by the IT department of the particular organization or by some particular cloud provider. This model gives organization a high level of control over the use of cloud resources. It allow user to interact with local datacenter. E.g.: eBay.
Hybrid Cloud is combination of both private and public cloud. In this model user usually outsource non business critical information and processing to the public cloud, while keeping the business, critical service and data in the private cloud.

III. CLOUD COMPUTING AS AN ICT TOOLS FOR DISTANCE LEARNING

ICT become very important part of conventional and distance education. In distance education ICT can be utilized for better teaching and learning process and improve the quality of education. With the help of cloud as ICT tool in distance education, learner can avail live video conferencing lecture from prominent lecturer. The educational cloud computing can focus the power of thousands of computer on one problem, allowing researcher to build a smarter planet. The universities can also open their technology infrastructures to private, public sectors for researchadvancements.Educationalcloud computing services providesanincreasing variety of beneficial services available today on the web, which is also thefastand most advanced developing component of technology and education. Due to implementation of cloud learner or educatorcanaccesshighly configured virtual machine or other resources as and when they required and can perform necessary task. Different study material, lecture by eminent scholar or educator can be stored in cloud and these can be easily accessed by learner any time anywhere. Student can also store their important data or assignment in cloud. The service level Platform as a Service, allow different users to access advance services such as database, operating system etc., as well as to create uniqueand newservicewhichcaninturnbehostedontheplatform. PAAS make cloud computing extremely versatile. The service level Software as a Service allow cloud computing user to access wide variety of software and applications at minimum cost or no cost. So any user can use different software required for study purpose or research purpose, without installing those in the local computer. Due to the adaptation of cloud computing as an ICT tools will minimize the budgetary constraint of educational institute to set up an ICT infrastructure.

IV. BENIFIT OF CLOUD COMPUTING AS A TOOL

The proposed architecture will provide several benefits [7] following are some of them

A. Large storagecapacity:

This architecture will provide a large storage capacity at minimum cost and also provide powerful computing. So any user can store their valuable information at low cost.

B. Highscalable:

It is highly scalable since computing resources and power are made available via distributed service virtually. Large number of user can access different

resources smoothly without any anomalies. Virtualization technique integrates several re- sources from a huge computation and storage network, such that user only need a simple computer with internetconnection to access those resources

C. ***HighSecurity****:*

This will provide high security to the users' data.

D. Costeffective:

Proposed architecture will provide much software on free or pay per use basis. So it will minimize the cost of buying particularsoftware.

E. Minimize the maintenancecost:

This will minimize the software up gradation cost. This is because the users need not to upgrade the software. It will upgrade by the cloud service provider. It will increase the openness of the student to the new technology.

V. CASE STUDIES OF EDUCATION CLOUD PROVIDER

Educationalcloudcomputingservicesofferagrowingva riety of services over the internet. These different services have changed the concept of education. The cloud computing in different university or educational institute provide direct ac- cess to wide range of educational tools, research application, academic resources etc. The educational cloud computing is offered by many leading IT companies, such as Microsoft, Google, Amazon, IBM, HP, Salesforce, ZMANDA etc.

A. Microsoft EducationCloud

Microsoft Education Cloud enables educators and students to flow workloads across the infrastructure. Microsoft Education Cloud offer services like Microsoft Live@edu, Microsoft Windows Azure etc. [8] [9]. Microsoft Live@edu is a cloud developed for education which is used by more than 22 million people across the world. Live@edu offers education institute free, hosted, co-branded communication and collaboration services for students, educators and staff.By signing up for Live@edu, educational institutes gain access to a comprehensive suite of services which include Outlook Live for e-mail, Office Web Apps, Windows Live Messenger for instant messaging and Windows Live SkyDrive for 25 GB of online data storage space; preparing the students for thefuture. Following are some features of Microsoft Live education-

•Website Creation
•File sharing
•File storage
•Word Processing and presentation
•Desktop sharing
•Resource scheduling

Windows Azure is Microsoft's application platform for the public cloud. In several ways our applications can use this platform. Three services of Azure's are Azure Operating Sys- tem (Platform as a Service), Azure .NET Services (Software as a Service), and Azure Hosted Services (Application as a Service). Azure Platform Service (ASP) offer services such as Service management, online Computing, data storage etc. Following are some components of A S P

•Windows Azure
•Microsoft .Net service
•Live Services
•Microsoft dynamic CRM services
•Microsoft SQL services

B. Google EducationCloud

For education there are numerous number of free sets of communication and collaboration tools that includes email, calendar, and documents available in Google. Google Applications are widely used by students, teachers, and administrators in different types of institution around the world. More than 30 million people are using Google Educational applications, because these are:

1) **Collaborative:** Collaboration of Google Applications is very fast and easy.These applications provides a great platform for teamwork, real-time editing, powerful sharing controls and compatibility.

2) ***Customizable:***Setting up different security settings, features options and account permissions to meet our Institution's needs in Google applications is relatively easy. E.g. turning email off for fifth graders, allowingsecond graders to email classmates.

3) ***Free:***Google Educational Applications are freely available for Educational Institutes which includes 24x7 online, telephone and emailsupport, an online teacher training center and also migration and syncingtools.

4) ***Secure:***Data security of users is the peak issue of Google, for that Google engages more than 400 full time engineers to protect our information.

5) **Without ads:** Ads are the one of the uninteresting staff faced by users in the internet, that's why there are no ads in Google Educational applications and for advertising purpose Google does not use student data.

6) ***Usable on any device****:* Google Applications are developed keeping in mind that applications should run in any device. So, Any Educational

Institute, which have devices like Laptops, Desktops, iPads or Android tablets etc., Google Applications will work.

Google App for Education include the following apps:

Gmail- Students and faculties are connected instantly with the help of mail, voice calling or chat. We can customize the Google account by adding our own logo.

Google Calendar- We can manage all important events with the help of Google online calendar. We can plane our lessons and organize different schedule whenever required.

Drive- Google Drive is just like our small external hard disk, where we can store, preview, delete and modify our documents and files with the help of internet. Even we can share our drive files with colleagues, friends and students.

Google Docs Package- It is a real time collaboration on documents, spreadsheets and presentations that enable the researcherandstudentstoworktogetheracrossoverthe world. **Sites-** User can create or published a web page without writing a single code.

C. Amazon EducationCloud

Amazon Web Service provide several cloud services which are needful for our organization. With AWS learner, re- searcher or faculties have the flexibility to select whichever service or deployment model required to solve their problems. Amazon Web Service provides computation, Networking, Storage and Content delivery, databases and many application services etc. AWS some extensive widely used cloud computing platform as follows:

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers and system administrators. It provides us with complete control of our computing resources and enables us to run on Amazon's proven computing environment. It also provides APIs to manage the data resources and a full management console. Some features of Amazon EC2 are [10]

1) ***Flexible****:* - In AWS from many Amazon EC2 instance types, operating systems, and software packages we can choose our own. The best flexibility is that it allows us to select memory configuration, Boot partition size, and instance storage for our choice of operating system and application, which totally meets the idea of virtualization in cloud computing area. [15]

2) ***Elastic:***Amazon EC2 enables us to manage the capacity within a second . We can work on thousands of server instances simultaneously. Amazon EC2 also provides a reliable environment to its users.

3) **Completely Controlled:**Amazon EC2 service is providing full Amazon EC2 instances controls to its users, where users can have root access and they can interact with each instance. Users can on their boot partition while retaining data and the subsequently restart the same instance using web service application program interfaces.

4) ***Inexpensive:***Amazon EC2 is very inexpensive.

We can access any instances at very minimum cost. Amazon EC2 provide several instances purchasing option those are On Demand Instance, Reserved Instance, and Spot Instance.

5) ***Secure:***For storing our data and instances Amazon provides very secure environment.

Amazon CloudFront is a web service which is mainly deal with content delivery. This web service embedded with other web services in AWS to provide developers and businesses an easy way to deliver content to end users with low latency,high data transfer speeds, and minimum commitments.

AWS Lambda is a computing service which provide us with platform where we can run our own program within seconds and manages the resources for us, which makes very easy for us to develop various types of applications.

D. IBM EducationCloud

The objective of the IBM Cloud Academy is to provide a computing environment for education institutions. In such institutesdevelopercaninnovatenextgenerationcloud computing technologies. With the help of this they can collaborate with their partner, as well as other peer member. [9] [12]

Goals of IBM Cloud Academy

•To improvise the education system IBM cloud provide a forum for successful deployment of cloud computing models.

•Gain early insight of and access to emerging cloud computing technologies development and research from IBM and partners.

•IBM cloud develop storage for different cloud computing curriculum, and several tools and resources for education, teaching, research development and implementation.

•To evaluate technical, financial and service qualities of cloud computing IBM cloud provide several pilot projects and collaborative program.

E. HP EducationCloud

HP Cloud Service Automation (CSA) provide all three deployment model those are private cloud, public cloud, and hybridcloud.HPcloudsystemistheproductofHP'sthatprovide several application management, automation system, infrastructure to industries or to educational institute. The users such as learner, teachers and researchers that uses HP cloud can developed, manage, and consume different services of cloud via private clouds, public cloud orhybridcloudswithout any concern, from where those services come, whether itcomefromHPCloudSystem'sownresourcesorfrompublic domain. From a bulk source HP Cloud System offer several applications and services and it is highly scalable. HP's core cloud system consists of following [14]

•HP BladeSystem Matrix
•HP Cloud Service Automation software
•Cloud Maps
•HP Storage
•HP Security Point
•HP Networking
•Mission Critical Computing

Following are HP Cloud Services Products [9] o HP Cloud Object Storage
o HP Cloud Content Delivery Network (CDN)
o HP Cloud Block Storage
o HP CloudCompute
o HP Cloud Relational Database for MySQL
o HP Cloud IdentityService
o HP Cloud Application Platform as a Service.

F. Saleforce.com EducationCloud

Salesforce created the Sales Cloud which is easy to use as the cloud application provided Amazon. Sales Cloud minimize the risk and cost associated with traditional software. By pioneering the concept of cloud computing, Salesforce delivered its applications over the Internet to the remote location. It enables its user such as educators, researchers, students etc. to access different application from different location. Becauseof the open architecture and automatic updates of Sales Cloud, it eliminate the hidden costs of implementations of traditional CRM software. Following are some Sales Cloud features [9] [12]

•Mobile: With the help of Salesforce1 Mobile App we can use our mobile device as a portable sales office. We can perform several task such as log calls, respond to hot leads, work opportunities, or check dashboards no matter where we are.

•Workflow and Approvals: Use Visual Workflow to rapidly design and automate any business process with drag- and-drop simplicity.Anddrivesuccesswithflexibleapprovals processes for deal discounts, expenses, and more.

•Inside Sales Console: Give inside sales teams an experience that matches how they work, and they shall work smarter, faster. Now reps can see sales intelligence, detailed company info, and multiple leads on a single screen, so they shall build pipeline and grow deals faster.

•Email Integration: Use the email applications we already know. No one needs to change the way they work, soeveryone staysproductive.

•Files Sync and Share: Now it's easier to share files, discuss them, publish the best, and track our content in real time. Quickly find what we are looking for, share it securely, and even subscribe to receive alerts when something changes.

A comparative study of different features of different cloud service provider are shown in table I

VI. CONCLUSION

Distance education plays a vital role in present education system in India, but there are several problems with distance learning. These problems can be overcome with implementation of cloud computing as an ICTtools.Implementation of cloud will minimize expenses of educational institute. Educational cloud computing services represent a growing variety of useful services available on the internet and the most innovative and rapidly developing portion of technology and education. Implementation of Cloud computing will increase the openness of the student to the new technology.

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TABLE I
A COMPERATIVE STUDY OF DIFFERENT CLOUD SERVICE PROVIDER SHOWN IN TABLE

Features	AWS	GAE	Microsoft Azure	IBM	HP
Services	PAAS, IAAS	PAAS, SAAS	PAAS, IAAS	SAAS	
Virtualization Technology	OS level running on XEN hypervisor	Multitenant Architecture	Hypervisor based on Hyper-V	Hypervisor based on VMware VSphere or KVM	Hypervisor based on VMware ESX, Microsoft Hyper-V and Linux KVM
Load Balancing	Service will allow users to balance incoming request and traffic across multiple EC2 instance	Automatic scaling and load balancing	Built in hardware load balancing		Dynamic load balancing i.e automatically grows as usage grows.
Supported operating system	Linux, Windows and Cent OS	Linux, Windows server 2008	Linux, Windows and Cent OS	Windows XP	Cent OS
Language Support	JAVA, PHP, Python, Ruby	JAVA, Python	PHP, ASP.Net, JAVA. Python and Ruby		JAVA, SQL
Security	AWSs data center use electronic surveillance and multi factor access control system. Data center are supervised by well trained security guards	Google secure data connector uses RSA/128-bit or higher AES. SDC use transport layer security based sever authentication.	Security token service creates security assertion markup language token according to rule.	IBM cloud enables customer to configure encryption. There are some additional control such as backup media, protection of data center on portable media etc.	

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