IMPLEMENTATION OF CLOUD FOR EDUCATIONAL INSTITUTION

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ABSTRACT

We present a first phase implementation of an educational institution processes on the cloud. We have taken a subset of activities that are typically performed on a regular basis when a course is being conducted. Today cloud technology is evolving very rapidly. Its impact on educational domain is gaining more importance. The continuously evolving Internet has made it easier for the world to communicate and collaborate. The main advantage of this technology is that it has provided an affordable or perhaps a free technology service for publishing, collaborating, social interaction, editing, content creation and computing.

In this paper we discuss what Cloud is, and its types and services offered. We then discuss how cloud can be implemented for an educational institution. In this paper, we will restrict ourselves to the use of Hadoop's HDFS to implement a distributed file system for sharing course related material. We also discuss what are the advantages of using cloud computing and its implementation in the educational institutions. We talk about scaling the available resources to use it as a cloud. Hence it has an advantage which will surely help the students when used in an appropriate way.

I INTRODUCTION

The term cloud is used in place of internet or networks. Cloud computing refers to a group of computers acting as servers placed remotely and can function or provide services to clients as per their needs. This concept is recently being used by many institutions for coping with the technological advances in the field of IT and making the optimum use of technology. With the help of cloud the institutions implement the feature of remote login (through browser) which enables the students to log into their accounts from the campus as well as off the campus. It provides quick access to the data and also reduces additional computing cost. It reduces the cost of infrastructure required for handling, storing large amount of data in universities. Cloud computing architecture for educational institutions provides with the advantage of collaboration with other institutions. This helps for research development, managed projects. This architecture also provides flexibility in terms of system failure or crash i.e., Data can be shifted to another location. The massive workload on the traditional systems is reduced by distributing the computing tasks onto the cloud clusters.

Cloud for institutions can migrate expenditure under Capex to Opex. The capital expenditure refers to the fact that stocking your own data centers, while using an external cloud service that offers pay-as-you-go service falls into ongoing operating expenditures. Putting it in simple words, we can use computer applications without even purchasing or running their softwares on the local computers.

Therefore, the implementation of a cloud is going to help students with the latest technology and thereby enabling the E-learning concept. Some of the salient features of cloud implementation will be like:-

- Common infrastructure for all educational institutions to conduct common classes, resource sharing.
- Lower hardware and software costs
- Enables E-learning

Cloud technology is scalable as it allows to extend as demands come and go or increase.
Lastly, students and teachers are able to easily access and store the data or any applications from anywhere as in cloud computing services are made publicly available.

II SERVICES

Cloud provides us with basically three types of services as :

- Software As A Service (SaaS)
- Platform As A Service (PaaS)
- Infrastructure As A Service (IaaS)

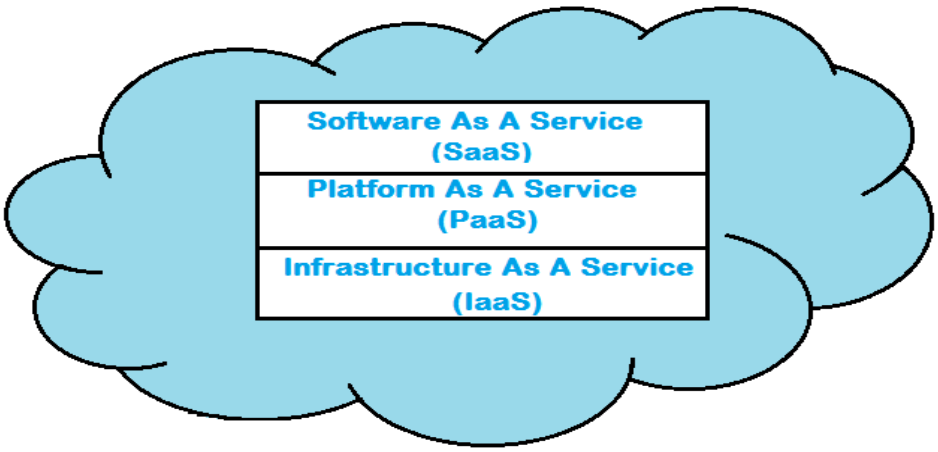

Fig : Cloud Provided Services

2.1 Software as a Service (SaaS)

This service enables us to use an application which is present and running on to another machine/ system present on cloud. With this service we need not install the complete application on user system. The best example can be web based emails, acrobat.com. By implementing cloud for educational institution, traditionally installed software on each user machine is no more a requirement.

2.2 Platform as a Service (PaaS)

With PaaS, we can develop our own application but the required hardware and software specifications are not of user concern. These specifications are cloud provided and are updated, monitored by cloud itself. For example, consider we need to develop an application which requires development tools such as JDK, .net, etc. These tools are provided by PaaS service. This is cost effective in terms of buying hardware or sub software layer specifications related to our developing application.

2.3 Infrastructure as a Service (IaaS)

IaaS provides access to the hardware services and infrastructure for hardware and software configuration. This service gives us storage of user data such as file server, application server on the cloud which can be accessed at any time.

The best example can be gmail, where all the mails are stored on to the google's cloud which are accessible at any time from anywhere.

III TYPES

Types of Cloud

- Public Cloud
- Private Cloud
- Hybrid Cloud

3.1 Public Cloud

Public cloud is used when cloud provided services are used by many users. These services are open for all public use. These clouds are owned and maintained by third parties. All users can access the same infrastructure pool with different availability, security. Google's cloud is one of the best examples of public cloud.

3.2 Private Cloud

These clouds are hosted and managed by single organization. The main objective of private cloud is to offer greater control and data security. These cloud services are accessible only to authorized members of the organization. The resource management and configuration is done by the organization itself.

3.3 Hybrid Cloud

Hybrid cloud is a combination of public and private cloud models. It not only provides the benefits of both public and private cloud models,but also overcomes their drawbacks. Hybrid cloud provides greater flexibility in computing.

We usually observe that there are individual systems installed in every part of the educational institution where there is unnecessary use of high configuration hardware and software, when all what is needed is a Thin clients used at each node.

This reduces the cost in purchasing the hardware and software and also saves the maintenance cost of such machines.

This brings forth the need to have a separate cloud for these institutions wherein the computing power and resources are provided by the cloud servers. Any kind of software that are needed by the users are available on the cloud servers and thus it helps to achieve cost efficiency.

III TECHNOLOGY

We will discuss about technology used and how HDFS is used for storing files related to the educational institution.

3.1 Technology Used

We have used Apache Hadoop 1.0.4 [1] as the underlying technology over which the files will be mapped and reduced.

GUI is developed using JAVA Swing utility for effective communication.

MySQL is used to store the information of authorized members as well as usernames and passwords.

3.2 Implementation

The types of actors which will be interacting with each other are

- Office Staff
- Teacher
- Student

3.2.1 Office Staff: Sign In related information like usernames and passwords are provided to the authorized person by office staff only.

3.2.2 Teacher: Important academic notices for students are posted by t eachers. Similarly, study material as well as assignments is also posted onto the HDFS which will be directly accessible to all the students. Responses to the queries asked by students are uploaded onto the HDFS and subsequently shown on their dashboards. List of notices, assignments and queries posted by students become visible to the teacher on teacher's homepage after selecting the respective option. This makes the operations easy for teachers for viewing assignments or queries.

3.2.3 Student: Student can see all the notices which are posted by teachers and office staff. Student can easily download study material or assignments at any time. Any student can directly ask any doubt regarding any subject to teacher and get response. Student can see list of all notices, study material, assignments and the queries along with their responses on respective pages after selecting particular option, which helps student to select and view particular notice, assignment or query response among all.

3.3 Hardware and Software Configuration

Our cloud setup is basically a 3 node cluster, with 1 master and 2 slave machines having configuration as follows

Processor: Intel i5

Hard Disk: 500GB

RAM: 4GB

Operating System: Unix

The files which are stored onto the HDFS are basically in the form of replicas of replication factor 3. Each file in HDFS is stored in the form of sequence of blocks having block size of 64MB.File once stored on the HDFS is written once and read as many times as we want.

3.4 Advantages

3.4.1 Data reliability: Whenever any node stops functioning due to any malfunction, the file can be easily accessed as the replicas are still available on the other nodes. In this way, files stored into HDFS are accessible in circumstances of any node failure.

3.4.2 Authorized access: As Login information, such as usernames and passwords are provided to the authorized person by office staff only, hence no unauthorized person can gain access to the services of the cloud.

3.4.3 Disk Failure: Whenever a namenode crashes, we might lose the data onto the HDFS. But the secondary namenode enables us to keep a periodic check of the namenode data and thus we can still have some of the data available. (The next implementation of Hadoop will solve this problem completely.)

3.4.4 Reduced paperwork: The GUI created by using the JAVA Swing utility serves as an effective medium to use the services available and thus reduces the paperwork.

3.4.5 Reduced communication gap: As the various kinds of users like teachers or students have an efficient mode of communicating with each other, it reduces the communication gap between them as well.

IV FUTURE SCOPE

This implementation can be used as a base for developing actual cloud by increasing the number of machines, storage space and computing power. The model which we have developed is a prototype which can be further extended to university campuses as well. Students will be able to perform practical exams on the cloud from anywhere due to remote login and the marks will be notified to respective student on cloud. The three node cluster has the limitation to use the system at its place. So, the concept of remote login can be added to it through which the users can use the services from their systems anywhere around the globe.

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