

Secured Cloud Adoption Architecture for Educational Institutions

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ABSTRACT: Cloud adoption is widely popular in all enterprises and institutions in today's scenario. This paper describes how cloud is adopted in educational institutions. Cloud provides many benefits to users and it also has some security related issues in its adoption. To address the security problem in the cloud adoption in educational institutions, this paper proposes an architecture for secure adoption of cloud in educational institutions. The proposed architecture provides many benefits to users with a secured cloud environment. The architecture uses four security parameters that are Authentication, Authorization, Confidentiality and Integrity. These four parameters are used to secure the cloud environment from the user's side to the cloud environment. Authentication and authorization are used to check the entry of users to identify unauthorized access. Confidentiality and integrity are used to ensure that the content in the cloud environment is only accessed by the authorized users.

KEYWORDS: Cloud computing, Security, Storage, Institutions, Data center.

1 INTRODUCTION

Recent advancement in the field of computing is cloud. Cloud is a technology which evolves from existing technology like grid computing, parallel computing, distributed computing, utility computing and etc. hence, it is not a new invention, but cloud redesigns all the characteristics of existing computing paradigms into a new trendy and heavy capable computing architecture. Cloud is not a single server computer to process the request of the users. According to NIST [1], cloud is a model for enabling convenient on-demand configurable computing resources like network, server, OS, memory and etc. are provisioned to users based on their requirements. Cloud provides the computing resources as a service. Generally, cloud has three services, Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Cloud services are provisioned to users in an on-demand manner [2].

The main concept running at the bottom of cloud is virtualization. Cloud provides the services to users in a virtualized manner. For example, consider the Google search engine online software, there is only one copy of this Google software running in the Google cloud server but it is virtualized up to any number of users those who request this software in their browser. A virtual copy of this software is taken from the cloud server and forwarded to the user's machines. Hence, virtualization is the backbone of cloud service provisioning system. Simply saying cloud is an unlimited service provisioning system because of scalability. Cloud is scaled up and down enormously up to the demand of the service. Any number of users use cloud at any time and any number of times and anywhere in the world. The philosophy of cloud is Everything (X) as a Service (XaaS); X denotes any services like software, platform and infrastructure [3].

Cloud is most useful to businesses and helps them to grow up without any computing infrastructure. Businesses use the cloud infrastructure for their processing in a subscription basis. The reason for use of cloud is to store huge amount of data in

the cloud server. Normally a small scale enterprises or an educational institution does not have computing infrastructure to keep all their data in their premises. This hurdle is easily rectified by the cloud computing system. Cloud allows educational institution to keep their data in the cloud data center. Cloud data center is a place which holds thousands of server computer and unimaginable networking and storage and cooling system to cool the entire data center. Hence it is a well-equipped infrastructure to provide unlimited provisioning of computing resources [4].

Educational Institutions (EI) data are kept in the cloud data centers which are situated in different geographical environment in the world. But users do not know the location of their data stored in the cloud data center. General cloud architecture with different data center is represented in the figure 1.

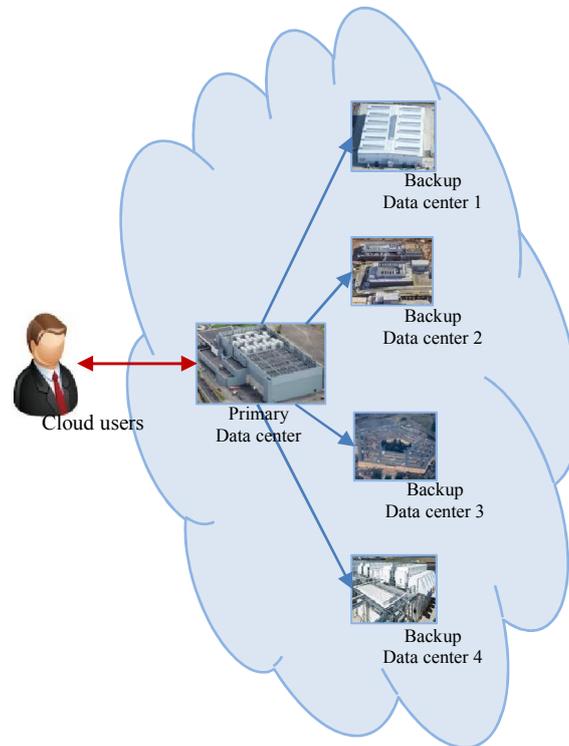


Fig. 1 Cloud Computing with data center

Each data center is controlled and monitored by the different admins from the Cloud Service Providers (CSP). The huge amount of computing capability in cloud enables data outsourcing. Outsourcing is the process of a task to be done by third party service providers. Cloud allows data outsourcing to users to keep their database in the cloud in low cost. Location of the outsourced data is not known to the users. They also don't know who are all from the cloud side access the data. This nature of cloud computing brings data security related issues. From survey of IDC about cloud computing [5] issues and challenges, it shows that security is top most issue in the cloud environment. Hence, apart from the enormous advantages, it also has data security issues. It is necessary to develop secured cloud architecture for the users like educational institutions.

2 BENEFITS OF CLOUD ADOPTION IN EDUCATIONAL INSTITUTIONS

The cloud provides many benefits to its users when it is adopted by them. The followings are the list benefits derived from the cloud adoption. [6-12]

- The major advantage of the cloud adoption in educational institutions is that it goals at promoting easy access to expensive software running on high performance computing to rural students.
- Cloud delivers opening for using ubiquitous computing.
- Data in the cloud are accessed everywhere so no need to take copy of data from one PC to another.
- Cloud has huge number of supercomputer.
- Protect data from crashes.

- The cloud computing model stores data intensively. Based on the data center, the CSP accomplish the combined data, allocate the resources, balance the load, deploy the web application, and real time monitoring.
- Cloud discovers the processing and data in a huge set of distributed servers. The thousands of computers in cloud data center provide powerful computing power and huge data storage space.
- Cloud provides high availability of data and service at anytime and anywhere. Cloud provides higher quality of service and high-performance computing power. Cloud computing system can automatically detect the failed node and exclude it from operation without loss of data; it does not affect the other process of cloud.
- Virtualization is the most important characteristics of cloud architecture. Application development and hosting environment is different but it is managed by virtualization in cloud. It has fundamental hardware such as servers, OS, memory, storage, networking and virtualization components to form pool of shared resources and distributed on-demand computing.
- Cloud users can work from any places like home, work and library to get their data and modify them through the cloud applications and applications can also be accessed through various devices like mobile, laptop and desktop computers, provided with internet access.
- Cloud applications are mostly in no cost and it is accessible instantly.
- Users feel a wealthier learning experience, even outside of educational institutions.
- Cloud is a cost-effective solution to institutions for their students, researchers and faculty.
- Cloud is more flexibility infrastructure with minimum investments. Cloud computing is elastically scalable and dynamically provides resource in an on-demand.

3 CLOUD ADOPTION IN EDUCATIONAL INSTITUTIONS

Due to the advantage of cloud, it is attracted by the Educational Institutions. Educational Institutions are easily adopted the cloud and outsourced their data in the cloud. Once the cloud is adopted, all the features of cloud are inherited to the Educational Institutions. The general architecture of cloud adoption in Educational Institutions is shown in the figure 2.

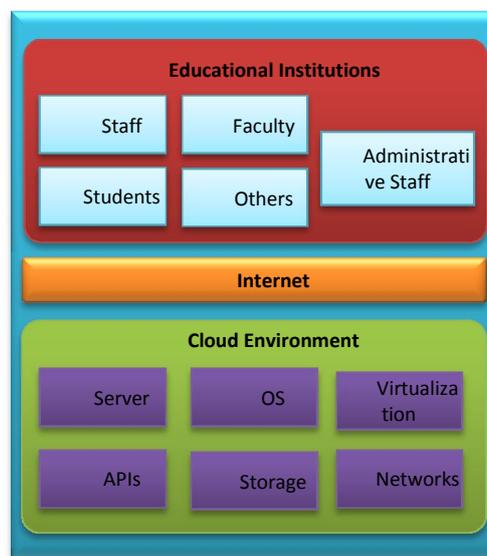


Fig. 2 Cloud adoption in Educational Institutions

Cloud enables the Educational Institutions with current IT infrastructure. Educational Institutions need medium configured computer with internet access; it helps to effectively use the cloud services. Cloud has all recent version of software and also it has all original version of software. It helps the students to work with latest version of software. Followings are benefits of cloud adoption in Educational Institutions [13-14].

➤ *Application collaboration*

The most important advantage of cloud is collaboration of services. According to IDC survey 67 percent of survey respondents believe collaboration applications such as email, chat, conferencing and collaborative file sharing solutions are a great fit for the cloud because they reduce costs in the short term.

➤ *Migrating Web Server*

Migrating from web server to cloud is also at the top of the prioritized list. Because cloud will reduce maintenance costs and reliance on subscription models as well as improve rapidness of deployment.

➤ *Cloud data backup*

Cloud provides 100 percent disaster recovery and back-up of data from physical loss. Data in cloud are not damaged physically because cloud maintain back-up data center for all the data in the cloud. If any data center is fully collapsed by nature disaster, then the back-up data center is helped to recover the data without any loss.

➤ *Applications for Business*

Web Applications deployed in the cloud are possibly the most talented cloud services and the most stimulating topic for computer science education because it can give option to pay for what they use while providing the big-impact of benefit at latest technology advancements.

Apart from all this benefits, it is noted that security is the top most issue in cloud adoption. It is necessary to have a secured architecture for cloud environment to address the security issues.

4 SECURED ARCHITECTURE FOR CLOUD ADOPTION IN EI

Security plays a vital role in cloud adoption; it is addressed by different security parameter like Authentication, Authorization, Confidentiality and Integrity. If any of the parameters are compromised, then security problem issues are raised. Figure 3 shows the secured cloud adoption architecture for educational institutions. The security parameters are included on their place to secure the cloud environment.

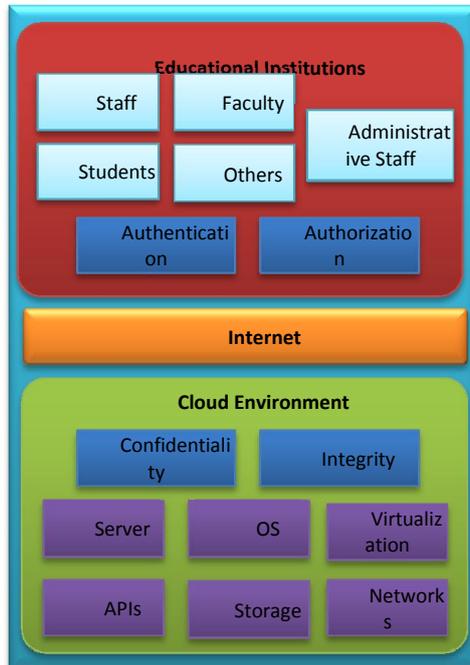


Fig. 3 Secure cloud adoption in Educational Institutions

Authentication is first level of checking to verify the entry of users with their credential. Users' credentials are maintained by the cloud system. Initially the users are registered with the cloud and if they want to access any content form the cloud they must provide their credential at the time of entry.

Authorization is second level of security. Authorized users are assigned with role what they can play in the cloud system. This role is defined by the cloud or users of cloud like Educational Institution based on the level of users. Users authorized by the cloud could access the content based on their authorization can view or edit or upload new content. For example, the student users only have access right to view and read the content. They are not allowed to modify or edit content in the cloud. They also do not have access rights to view the administrative content stored by the higher level of user. The faculty users have rights to view and edit the content in the cloud and also they can upload new e-content in the cloud.

Confidentiality is the next important parameter of security; it is used to secure the data from un-authorized users. Educational institutions not only use the cloud for storing content of student but also they maintain all details of entire institutions in the cloud. Data may be sensitive need more security. There are different cryptography techniques [15-16] are available for securing the sensitive data in the cloud. Institutions may use an efficient cryptography technique to convert the data into unreadable form.

Integrity is the final level of security should identify whether or not any un-authorized access is made. It is used to check the integrity of the content stored in the cloud. Integrity ensures the content in the cloud cannot be modified or altered by unauthorized users. There is a log detail maintained in the cloud which denotes who are all access the content in different time. Based on the information, it is identifying the user access list for a particular file. It can be an easy identification of malicious access to a specific content in the cloud [17].

Computing resources are provisioned in unlimited manner. The Educational Institutions are no need to worry about the service limits of the computing resources. They can use as much they need and pay for what they used in the cloud [18]. Using this framework model, institutions can securely store and share their content with different levels of peoples. This architecture provides the maximum protection to sensitive information stored in the cloud.

5 CONCLUSION

This paper is proposed secured cloud adoption architecture for educational institutions. This architecture helps the educational institution to securely store their data in the cloud environment. To ensure the security of the cloud environment, four security parameters are used in the architecture. These four parameters are actively protecting the authorized entry to the cloud environment and also ensure that the data used in the cloud is only access by the authorized users from the educational institutions. The role of different users like students, faculty, administrative staff and etc. in the educational institution is defined in the authorization parameter. Based on the role and privileges the uses access their data in the cloud environment.

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