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Implementation of Cloud Computing in Higher Education

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ABSTRACT

All the organizations are trying to reduce capital expense without compromising on service level and controlled increase in variable expenses. The success or failure of any cloud solution is governed by the above mentioned parameters. Therefore each cloud solution needs to be studied in detail to derive the generalized solution. In line with this there is huge need to research cloud based IT applications in education sector to derive the cost-effective optimal solution by reducing infrastructure costs, software cost, manpower costs and without reducing the service level. In this paper, concept of cloud computing and its evolution have been presented. Especially the significance of cloud computing in education sector has been described along with the benefits.

Keywords: C**loud Computing; Education Sector, Information Technology applications.**

INTRODUCTION

The Cloud Computing is the next stage in evolution of the Internet. The cloud in cloud computing provides the means through which everything from computing power to computing infrastructure, applications, business processes to personal collaboration can be delivered as a service, wherever and whenever there is a need [1]. Cloud storage data usage in the year 2020 is estimated to be 14% resident and 34% passing through the cloud by IDC [2]. The Cloud computing has emerged as the optimal solution to meet the requirements of cost effective, scalable and secure systems. It transformed the economics of IT infrastructure from capital intensive to pay-as-you-go. Over the past few years, it has been observed that India's Education Sector has tremendous requirement of IT infrastructure and therefore has become an appropriate sector for implementation of cloud applications. Today, our country has largest Higher Education System in the world in terms of number of institution and ranks second in terms of number of enrolments [3].

While, India has shown impressive growth in number of institutes and enrolment in the country, it still faces challenges on several fronts including shortage of qualified and expert faculties, insufficient Information Technology infrastructure as well as deficiency in quality of research and development [4]. Today a prime concern for our country is to utilize the IT resources optimally and to minimize the e-waste. To achieve this, the education sector in India needs cost effective, robust software applications that supports on-line learning platform and which can deploy infrastructure from anywhere at any time. Existing conventional IT system are not scalable and require high capital expenditure. The education institutes of all sizes and across all geographies should be able to access IT resources and computing infrastructure that were out of reach earlier. Therefore, the adoption of emerging cloud computing services is the optimal way to reduce cost of IT infrastructure in the education sector. The paper will meet the objectives i.e. to study the concept of cloud computing and its interdisciplinary relevance as well as will provide base to develop a generalized framework for education sector based on Cloud Applications.

The objective of this study is to review the recent applications of cloud computing, its evolution and to present significance of cloud computing in education sector. The rest of the paper is organized as follows: Section 2 presents a brief concept of cloud computing and its evolution and section 3 reviews related literature. Section 4 presents the importance of cloud solution in education sector. Finally section 5 provides conclusion.

CONCEPT OF CLOUD COMPUTING AND ITS EVOLUTION

The research in these Cloud based application has relevance in various disciplines like Computing, Management faculty, Service Sector and diverse industry domains. Research needs to happen in areas where the trained manpower is required to operate the Cloud Based IT applications and moving the usage of IT applications to those geographical

areas. This will achieve the work-life balance for the trained manpower and give options to the educational institutes to offer these advantages to their employees.

Cloud Computing concept came into existence in 1950 with implementation of mainframe computers and accessible via thin/static clients. Since then, cloud computing has been evolved from static clients to dynamic ones from software to services. The Fig 1 presents the evolution of cloud computing and a paradigm shift from mainframe computing to internet computing which further advanced to cloud computing. Cloud Computing is an emerging computing paradigm in which resources of the computing infrastructure are provided as services of the internet [5]. It is a successor of grid computing paradigm, utility computing and cluster computing [6]. All these computing viz. Grid, Cluster and Utility computing, have actually contributed in the development of cloud computing.

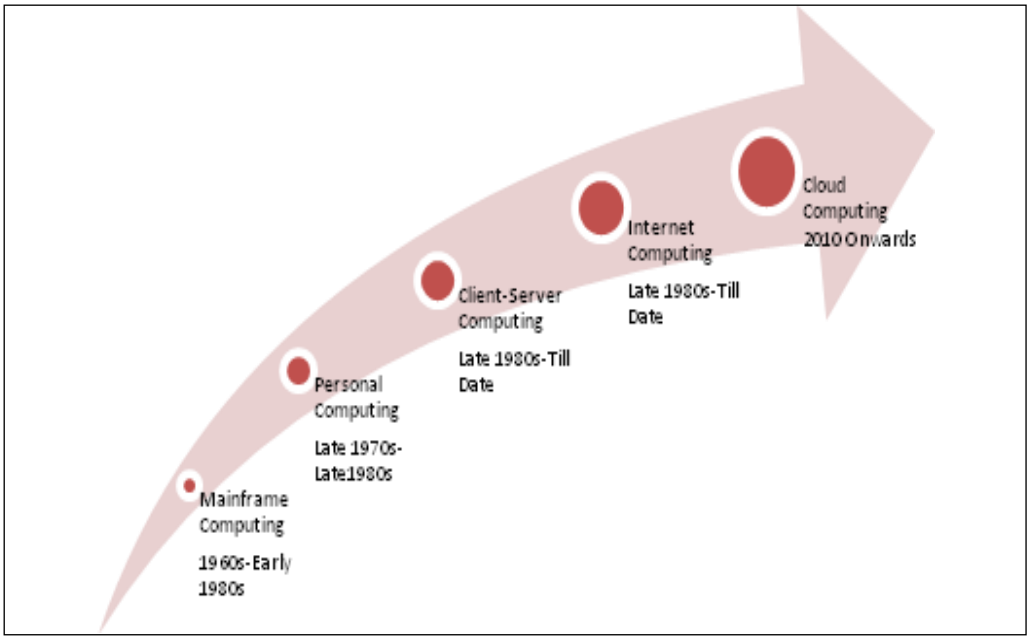

Fig 1. Evolution of Cloud Computing

There are two distinct sets of models for cloud computing. The first one is Deployment Model which refers to the location and management of the cloud's infrastructure. The second one is Service Model which consists of particular types of services that can be accessed on a cloud computing platform. As per U.S. National Institute of Standards and Technology (NIST), there are four types of Deployment Models for Cloud ie. Public, Private, Hybrid and Community [7]. The Private Cloud also known as Internal or Corporate Cloud allows systems and services to be accessible within an organization. It provides hosted services to a limited number of people and also offers increased security because of its private nature.

The Public Cloud infrastructure is available for public use alternatively for a large industry group and its own by an organization selling cloud services which is easily accessible to the general public. Public cloud may be less secure because of its openness [5]. The Hybrid Cloud is amalgamation of public and private cloud. However, the critical activities are performed using private cloud while the non-critical activities are performed using public cloud. The Community Cloud allows systems and services to be accessible by group of organizations. Three types of Service Models have been universally accepted for Cloud Computing. These can be categorized into three basic service models ie. Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). IaaS provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc. PaaS provides the runtime environment for applications, development & deployment tools, etc.

SAAS model allows using software applications as a service to end users. The research in these Cloud based application has relevance in various disciplines like Computing, Management faculty, Service Sector and diverse industry domains. Research needs to happen in areas where the trained manpower is required to operate the Cloud Based IT applications and moving the usage of IT applications to those geographical areas. This will achieve the work-life balance for the trained manpower and give options to the educational institutes to offer these advantages to their employees. The working of cloud computing is illustrated in figure 2.

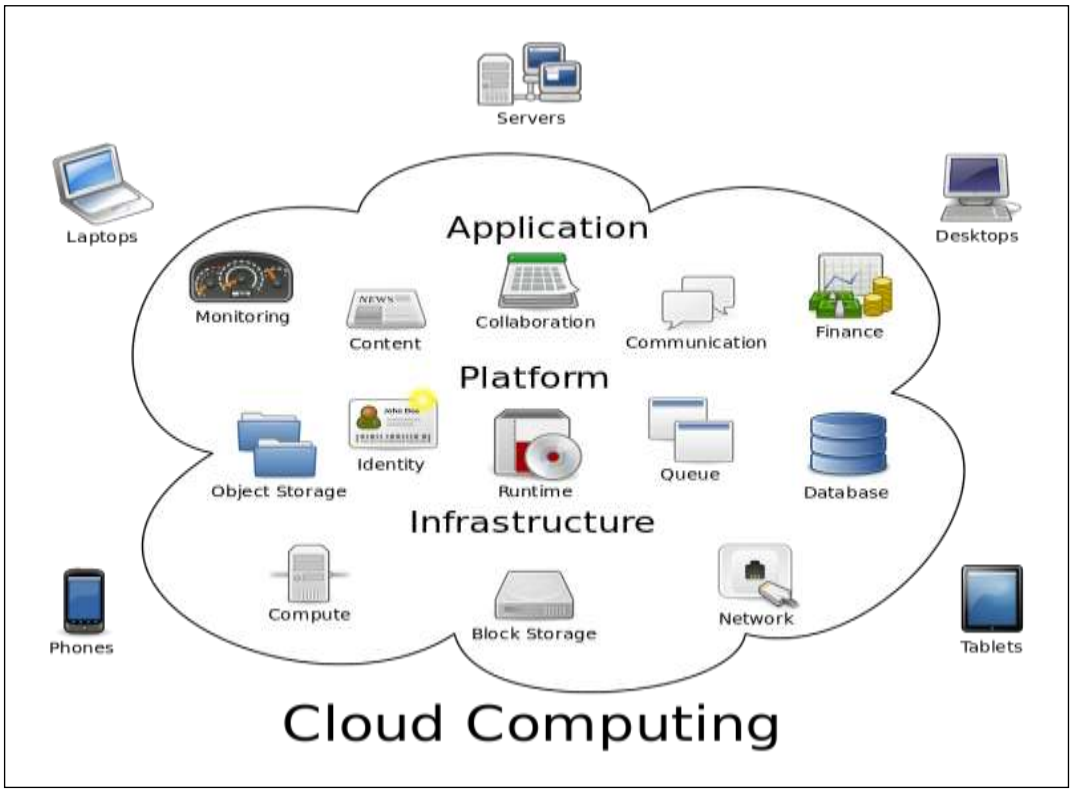

Fig 2. Cloud Computing

Cloud resources are usually not only shared by multiple users but are also dynamically reallocated per demand. This can work for allocating resources to users.

LITERATURE REVIEW

The purpose for the literature survey is to understand the application of cloud computing in various sectors. This study refers to a variety of materials in order to carry out a thorough and comprehensive literature review in relation to cloud computing and its profuse growth in market capture. Resources are mainly drawn from books, academic journals, magazines, information on World Wide Web etc.

As per survey conducted by Gartner, the cloud services market is already 180 billion US dollar in 2015 which is likely to grow at accelerated rate [8]. As per study conducted by EMC and Zinnov Management Consulting, the cloud market in India is expected to be around 4.5 billion US dollar [9]. A. Armbrust et al reported in his research that when Animoto made its services available via Facebook, it experienced a demand surge that resulted in growing from 50 servers to 3500 servers in 3 days, no one could have foreseen that resources needs would suddenly double every 12 hours for 3 days[10].

Our literature review indicates there is significant gap in technical development of cloud based IT applications in education sector. These are some the relevant references for other service sector applications [11]. The study is carried out with reference to causes of failure in web applications [12].

Shivani Goel et al [13] have given an insight into the nature of cloud computing impact on ERP implementations and discusses various issues related to this. He has suggested some guidelines regarding the use of cloud computing technology in the ERP implementations of higher technical education institutions. Marinela Mircea et al [14] have found out alternatives to use information technologies while leading universities to improve agility and obtained savings. The paper also provided strategies for the use of cloud solutions in universities by improving knowledge in this field and providing a practical guide adaptable to the university structures. Liladhar [15] has analyzed the implementation of cloud computing on web application. He also discussed the advantages of cloud computing and issues related to cloud computing on web application. Dr Ashish Rastogi [16] has proposed a model based framework to implement cloud computing in E-governance. He has also discussed the various problems that have been identified in implementing the various phases of the E-governance in developing countries.

Amrit Shankar Dutta [17] has provided educational cloud architecture and use of cloud computing in education. He has also provided many examples through the world where educational institutes have taken initiatives in cloud computing to better serve their faculties, students and researchers. He has also suggested the benefits of cloud implementation in education. Marinela Mircea [18] has provided an approach to use the mix of SOA, BPM and cloud computing in higher education. He has presented the current state of Romanian universities regarding the implementation of integrated solutions based on the latest technologies. Nan –Chou Chen [19] has studied the feasibility of the adoption of cloud computing in the development of Information Systems in IT Firms in Taiwan. Shahid Al Noor [20] has proposed architecture of cloud computing for education system in Bangladesh and discussed the impact of his proposed architecture on current education system of Bangladesh.

The study of related work reveals that there is plenty of scope for implementation of cloud computing in education sector.

IMPORTANCE OF CLOUD SOLUTION IN EDUCATION SECTOR

Over the past few years, India's higher education sector has witnessed tremendous growth. Today, the country has the largest higher education system in the world in terms of the number of institutions. India ranks second in terms of number of enrolments. While India has shown impressive growth in the number of institutes and enrolment in the country, it still faces challenges on several fronts including shortage of qualified and expert faculty, insufficient Information Technology (IT) infrastructure as well as deficiency in quality of research and development. Today, a prime concern for India is to create quality employable workforce to enhance its demographic growth towards optimum utilization.

To achieve this, the education sector in India needs cost effective, robust software applications that support online digital learning platform and which deploys infrastructure from anywhere at any time. Existing systems are not scalable and require high capital expenditure. The Cloud computing has emerged as the optimal solution to meet the requirements of cost effective, scalable and secure systems. It transforms the economics of IT infrastructure from capital intensive to pay-as-you-go. Adoption of Cloud computing services is the optimal way to reduce cost of IT infrastructure in the education sector. The education institutes of all sizes, across all geographies, can access IT resources and computing infrastructure that were out of reach. The current IT infrastructure is very disparate to the needs of technical institution, hence research needs to be done on development of reliable public cloud infrastructure at University or State level so that institutes get a secure access to this cloud infrastructure on need basis and be cost-effective.

Cloud computing promises several attractive benefits for Service Sector and Technical Education in India as there is a need of better Service at lower cost of delivery which is a combination of manpower cost and infrastructure. Cloud Technology for Service Sector provides flexibility on both counts as the task can be done anywhere and giving us to access to local manpower and help in reducing cost as it is a major cost saving technology.

Cloud computing promises several attractive benefits for institutes and end users. These are the primary benefits of implementing Cloud computing in education sector as mentioned below:

A. Self-service provisioning:

All stakeholders in educational institute would spin up computing resources for almost any type of workload on-demand.

B. Elasticity:

An educational institute can scale up as computing needs increase and then scale down again as demands decreases.

C. Usage based costing:

Computing resources are measured at a granular level, allowing institutes to pay only for the resources and workloads they used.

D. Collaboration and Flexibility

User of higher technical education have the universal access to projects, applications, documents so they can work collaborately using the collaboration tools provided by the cloud services through Saas. Also the cloud services are flexible to use anywhere and can be transferred to any location in case of failure or system crash.

CONCLUSION

The conclusion drawn from the above paper is that cloud computing gaining popularity as an inexpensive way of providing storage and software. It has been established that cloud computing will be helpful in improving the cost, maintenance and technical efficiency of education institutions. However, it is seen that apart from the benefits there are many issues like security which need to be dealt with. In future the paper can be extended by developing generalized framework of cloud based IT applications in education sector.

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