Use of Cloud Computing In Higher Education of Pakistan

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*Abstract***:** *Cloud computing is an internet-based service of delivering technology to users and an important technological facility where mutual resources are delivered on demand. Usage of cloud computing in educational Institutions provides students as well as administrative staff an opportunity to access various applications and knowledge swiftly. Its simplicity, upfront-cost, reduced downtime and less management effort make this service acceptable for all fragments of society particularly students and teachers. Despite the fact that the cloud computing technology is very useful, such as ease of access, cost effective. It has various issues like security violations, data confidentiality, data integrity, regional and geographical restrictions over the data. Safe cloud services are required to protect its users from different external threats such as disclosure or loss of data and compromising of users' accounts. Users' understanding about the cloud computing's advantages, disadvantages and security issues can protect them from potential threats while ensuring its optimal usage in education. In this paper, a survey has been conducted to identify students understanding about the advantages, disadvantages and security issues regarding cloud computing in the educational sector. A sample of 212 respondents from graduate and undergraduate programs was taken to obtain required information. The findings reveal a lack of awareness about the use of cloud computing, its benefits, and security concerns and the implications of this deficiency are critical as multiple issues like outflow of personal data and its loss is faced by its users which may have adverse social, emotional and professional effects on student's life. Considering the usefulness as well as the sensitivity of cloud computing in educational institutions, Authors propose maximum utilization of cloud computing in educational sector while ensuring the security of its users.*

Keywords: Cloud Computing, Security Issues, Education, Safe Technology

I. INTRODUCTION

The idea of cloud computing goes back to 1960's. At the point when John McCarty opined that "computing may some time or another be sorted out as a public utility". The term cloud computing is still confusing to many people because it can be used to mean almost anything. Cloud is utilized as an analogy for the web and its principle objective is customization and client characterized involvement.

Cloud computing gives shared sources, programming and data through the web as a PAYGO (pay-as – you-go) idea (Ahmed, Jaafar, & Ghareb, 2017).

The evolution in education is growing increasingly and the education system changing from outdated learning to online learning which is possible only with the aid of a computer. The computer has become the essential part of our life and it develops every sector for learning and to its professional role. It is really important to hold new technologies to increase and to manage with new educational activity and learning methodologies, by using online tools and technologies including cloud storage and cloud applications. Cloud computing is helpful in supplying all sorts of academic results. It is a model of delivering services, infrastructure and application software on demand bearing low cost and time efficient using the Internet. (Bulla, Hunshal, & Mehta, 2016).

Increasing computing speeds and advanced computer graphics technology enabled virtual environments of e-learning in the educational sector. Increasing internet speeds and storage areas together with the recent advances in cloud computing technologies, made the information available to everyone, from everywhere, at all times (Tolga One, Mehmet Bilge Kağan Önaçan, & Erkan Kıyak, 2016).

Clients can ask for assets as indicated by their prerequisites, for example information storage room, correspondence, preparing and calculation cycles required for their applications. (Sadvakassova, Serik, & Kultan, 2017). While discussing cloud everyone must have to tackle cloud architecture, legal, contractual and security and data privacy issues.

The problem dealt in this paper is lack of awareness about the use of cloud computing, its benefits, and security concerns to the students in the academia, the implications of this deficiency is critical and multiple issues like outflow of personal data and its loss is faced by its users which may adversely social, emotional and professional effects on students life.

In one case a cloud is directional for the peaks; the deployment process is rapid across the conformation because of the reduced demand for technological work to implement the services in individual universities or organizations. Computers with minimal specifications, capable of setting up a web browser, can be used as a web-based program for interactive learning. Cloud computing technology is flexible according to the scale and demand level that reduces its cost and more time efficient in educational activities (Karim & Rampersad, 2017).

Cloud computing model can be chosen based on Nature of the Business, Business Needs, Technical Requirements, Data storage medium and security aspects related to data (Hassam Hourani 2018).

II. PRESENT EDUCATIONAL SYSTEM

Educational foundations use information technology to a greater extent. They are improving outcomes in learning education for students. Similarly, these services are progressively utilizing Internet innovations not only for students but also for faculty to access from web programs as mentioned in **figure 1** and **figure 2**.

The current paper focuses on analysis of the emerging benefits and what are the challenges and difficulties of cloud computing in the educational sector. IT is playing a very little role in most of the government schools and colleges in Pakistan, Mostly work is completed manually from attendance to classroom teaching to examination system (Kiran Yadav, 2014).

Teachers taught students in the traditional ways where the learning outcomes are very low because most of the teachers are not technically aware of cloud computing technology toward its usage and benefits.

III. CLOUD COMPUTING TYPES

The infrastructure of the Private Clouds is provisioned for choosy use by a solitary association containing frequent buyers. It might be managed, owned, and worked by the various people and organizations which can be within the premises or outside of the premises (Maskare & Sulke, 2014). Private cloud only serves the organization's leaders (Specific to the Organization through a data center for its customers. No one has access to data except to the members or organization approved (Sukumaran, & Mohammed, 2018). None of these data is handled by others except the company.

Likewise, the Public Cloud is a cloud technology operating framework, offering software, which is free or accessible on a pay-per-use basis for general public use, processing or other services (Bibi & Sumra, 2017). Public cloud applications are provided on a pay-per-use basis by a particular service provider and operated by the service provider (Sukumaran, & Mohammed, 2018).

A Hybrid Cloud is a blend of at least two clouds (public, private, or community) that stay a remarkable element, but they work together and offer various combinational models. This model is collection of private & public cloud that gives services with transcription between these two (Bokhari, Makki, and Tamandani, 2017). A traditional cloud can be replaced with an open cloud for managing workload (Ab Rashid Dar, Dr.D.Ravindran, & M.Ramya, 2017).

A Community Cloud, which is also called a multi-tenant cloud service model which is mutual in different administrations, is overseen, secured and managed usually by all the sharing administrations. Community clouds, hybrid cloud is private clouds manufactured and worked particularly for a targeted group. These people group have comparative cloud necessities and their principle reason for existing is to work in coordination or joint effort to accomplish their business purposes (Ab Rashid Dar et al., 2017).
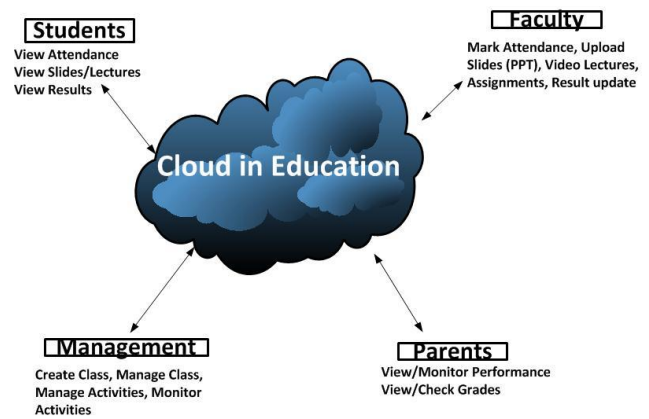

Figure 1: Cloud in Education

IV. SERVICES MODEL

In Software as a service (SaaS) users can get access anytime, anywhere and from every wherever to desired software applications controlled, operated and managed by the people who are providing the service. Presently, SaaS is getting the consideration by the people who are linked with the different level of education fields (Universities, college and schools). There are different types of cloud services provided by the different companies like: Google (Google Drive), Twitter, Dropbox, YouTube, and OneDrive. Both Microsoft and Google make available some services that are well appropriate for education, such as Live@edu and Google Apps.

In Platform as a service (PaaS) the people who are providing platform for services to develop and customizing the different kinds of tools or services to developers according to their requirements and needs. Google App Engine is the best example of PaaS where by using Python language a software developer can fix and modify their software applications.

Infrastructure as a service (IaaS) is a model in which software developers are allowed to manage, monitor and access their resources of computing like processors, storage, networks, etc. in the data center from far away, so they can install their own system software i.e. operating systems and other software applications. It is the huge benefit of IaaS that it provides you additional computing resources upon your request without installing new and lavish equipment. Amazon's Elastic Compute Cloud is one common example of IaaS (Al-Shqeerat, Al-Shrouf, Hassan, & Fajraoui, 2017).

V. CLOUD COMPUTING CHARACTERISTICS FOR EDUCATIONAL SECTOR

a. Data Storage

Cloud computing technology provides the service to the students to store data on storage servers placed in remote locations from anywhere.

b. Data Sharing

Users of cloud computing can share their data stored on servers from anywhere by accessing through the internet.

c. Distance Learning

Learning from distance in education becomes very easy due to cloud technology as teachers can share educational material with students as and when required.

d. Ease of Access

Rather than downloading and additionally introduce programming yourself, in the cloud it is altogether improved the situation (Hazreeni Hamzah, Mahmud, Mohamed Zukri, Wan Yaacob, & Yacob, 2017).

e. Pay per use

It is not necessary to buy expensive hardware to do routine tasks, but to take services from the cloud service provider on nominal charges as and when required.

f. **Rapid elasticity**

The cloud services are tools that can be easily supplied to the user based on the specifications and preferences of the system without impacting the software package or any human contact. In that situation, diverse people connected to this network (stakeholders) will connect and use IT services according to their requirements and at any time within an entity like an educator, employee, and management team (RAJESH 2017).
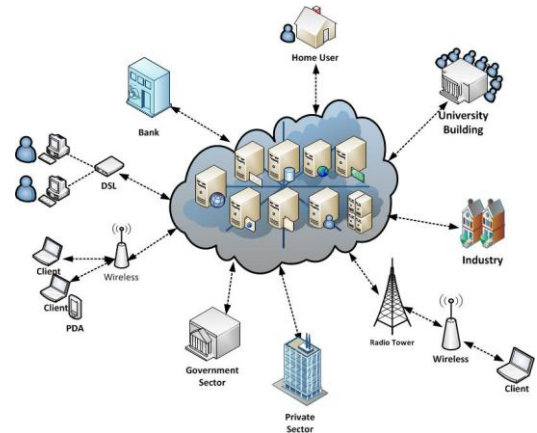
ROLE OF CLOUD COMPUTING IN HIGHER EDUCATION

Universities, government, business, academics, students and researchers have shown their contribution to the transformation of society and to the entire world economy (Mircée & Andrescu, 2011) as shown in the illustration of Figure 2, which is one of the key promoters of the social development. Cloud computing is very beneficial for many considerations in education. It will definitely authorize the academic institution to make real use of global internet tools to analyze data and store data (Tolga One et al., 2016).

The whole educational system is experiencing an absence of assets: little classrooms, staffing cuts, lack of qualified educators and always showing signs of change standards. In any case, as Bailey explains that, the cloud is an important device that can be utilized to enhance the quality of education and to help its accomplishment. These difficulties can be dealt with by number of courses with the assistance of cloud by including benefiting from economies of scale.

He suggested that the issue of obsolete, as well little, overcrowded classrooms can be tended to by virtualizing the classroom condition. Students can really sign onto a space on the web and go to classes outside of the classroom condition. In that capacity, the lecturer don't need to manage flooded classes and students pressed like sardines; rather, they can concentrate on making content students will comprehend, build up their students aptitude and it will help students in passing their exams.

Cloud enables students to share their thoughts, knowledge, ideas, tools and education infrastructure which comes about extraordinary diminishment in education organization's overhead uses are decreased on quality learning materials like books and programming and equivalent access to these assets and resources. In authors supposition students' academic performance should rise alongside the nature of education because of access of most recent reading materials.

Figure 2: Cloud for Higher Education

Limitations of cloud computing

Cloud computing, no doubt has the capacity for enlightening the effectiveness, cost and opportuneness for the universities and educational sectors, but there are few limitations as well;

I. All applications cannot run on cloud
II. It involves risk regarding data or information safety, protection, security and reliability
III. Organizational support
IV. Academic property, Propagation politics,
V. Safety and insurance of sensitive information
VI. Maturity of solutions
VII. Deficiency of assurance
VIII. Regular loyalty
IX. Low speed of internet can effect work procedures and methods (Mathew, 2012).

VI. LEGAL AND SECURITY CHALANGES OF CLOUD COMPUTING

Cloud computing term leads to a common understanding that is, serving their respective clients and users across the world and across the region regress of the location specification. With this technique private and public laws both effects the legal challenges of cloud. The service provider's major concerns are data protection of all the clients/ customers, protecting the rights as the requirement of the organization. So, the key challenge for service providers is to set accurate rights & protection. To tackle the situation the rules and regulation must be efficient, clean and clear for both ends. When the cloud computing involves cross region and cross countries environment then a complex environment must leads to contractual alignment for all stakeholders, customers, services providers and third parties as well. They must have to craft detailed contracts and make proper alignment with the law to complete their business tasks including support, future upgrades and implementation (Gordon, D. G., 2016).

VII. CONTRACTUAL PROVIONING OF CLOUD COMPUTING

Before starting any cloud service all terms and conditions, quality and scope of the service must be agreed between the concerning parties.

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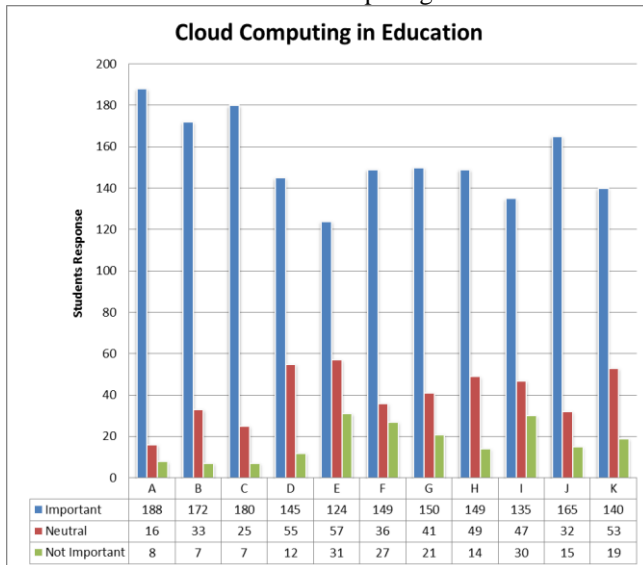*& Sciences Publication*

All stakeholders can achieve the agreements through complete detailed service level agreements (SLA's). All parties must ensure the alignment of SLA's and the laws and regulations of the regions. SLA must fulfil the regulations of the respective countries. (Robinson, N., Valeri, L., Cave, J., Starkey, T., Graux, H., Creese, S, & Hopkins, P. 2011; Gordon, D. G, 2016)

The only recommended solution for security measures is to give brief explanation with encryption techniques, recovery and backup management, disaster recovery, good governance, full comprehensive Service Level Agreements and complete security policy. (Singh, S., Jeong, Y. S., & Park, J. H, 2016; Mohan Kumar, M., & Vijayan, R, 2017; Gordon, D. G, 2016).

VIII. METHODOLOGY

To analyze the usage and awareness of cloud computing in public sector universities, a survey was conducted by authors. The purpose was to assess how much benefit public universities are getting from cloud computing. A close-ended survey authors has conducted at the University of the Punjab, which is one of the largest and oldest university of Pakistan to collect data from the students. The questionnaire was responded by 212 students; the frequency of male students was 85 which is 40.1% of overall students and female students were 127 which is 59.9%. Students from different level of degree programs participated to solve the questionnaire and respond the questions of Computing devices, Android Devices, Data Storage, Cloud Computing Knowledge & Usage, and Privacy of users while using cloud computing services mentioned below in the table 1. A Licker Scale of Important, Neutral and Not Important was used in the questionnaire.

Table 1: Use of Cloud Computing in Education

Cloud Computing in Education

	A	B	C	D	E	F	G	H	I	J	K
Important	188	172	180	145	124	149	150	149	135	165	140
Neutral	16	33	25	55	57	36	41	49	47	32	53
Not Important	8	7	7	12	31	27	21	14	30	15	19

A. Computing devices
B. Android devices
C. USB storage
D. Central location to store data
E. Store data on local drive of computer
F. Knowledge of cloud computing for students in academia
G. Availability of cloud computing in academia
H. Use of cloud computing services on mobile devices to facilitate students in managing and accessing the data
I. Sync your local device data to cloud storage in academia
J. To know privacy right / terms and conditions for cloud computing users
K. There should be regulatory Polices / Guidelines for the use of cloud computing in academia

IX. RESULTS

A. Desktop and Mobile devices

Desktop and mobile devices are the end user devices. Through these devices users use Cloud Computing services. The survey results indicated that 88.7% students are in the favor of computing devices to use the Cloud Computing services while 81% want to use Android devices as well. Which indicates the interest of users in using latest technologies. Android is a mobile operating system developed by Google. It is used by several Smartphone and tablets (Christensson, 2016).

B. Storage Mechanism

There are different ways user can get data from the cloud and store it. USB can be used as Flash Drive, Thumb Drive, and Removable Drive. It is a small data storage device. Flash memory store data and has a built-in USB connection (Christensson, 2008). An overwhelming majority of students (84.9%) according to survey results store data on USB drive. More than two third of majority (68.4%) to store data in a central location. (58.5%) students want to store data locally. Cloud computing is the provision of computing services—servers, storage, loading, databases, programming, software, analytics and more—over the Internet ("the cloud").(Microsoft, n.d.)

C. Use of cloud computing in academia

It is very important to have access to cloud computing in an academic environment. Survey results indicate that the majority of two third respondents which is (70.3%) desired to get knowledge of Cloud Computing. In educational institutions, availability of Cloud Computing services is necessary to get the services either to store data online or use cloud-based application online is important to (70.75%) according to students. Mobile cloud computing is basically a very good technique or model and it help us in developing mobile applications, powered and hosted through cloud computing. ("Mobile Cloud Computing (MCC)," n.d.). Use of Cloud Computing services on mobile devices to access data for educational purpose is important to (70.3%) students. Keep your data safe or as backup, it is necessary to store it on alternate storage media and according to the survey results (63.67%) students want to sync their data to cloud storage to secure their data.

D. Security of cloud computing

The privilege to be free from unknown reconnaissance and to decide if, when, how, and to whom, one's close to home or organizational data is to be uncovered("Privacy," n.d.). A two third majority of students, which is (77.83%) want to know the privacy rights for using cloud computing. Also, more than two third majority students (66.04%) want to have and know regulatory policies and guidelines to use cloud computing services.

X. CONCLUSION

Cloud computing is acknowledged in the society due to the benefits it provides such as enhancing accessibility with reduced costs. Latest trend indicates its prevalence in the education sector. Its utilization is seen more in the private sector in comparison to the public sector. The authors have conducted a survey in a public sector university to analyze factors with which its adoption can be enhanced in public sector similar to its utilization in private sector. Authors also gathered information about security aspects and security challenges for data integrity, data confidentiality and authorization. The survey results indicate the lack of awareness about its utility, complexity, benefits and policies. These parameters are basically the main hurdles for its adoption in public sector.

It is very clear from the survey's statistics that cloud computing should be used in educational institutions. The students consider it very important. Cloud computing facilitates students in learning. It has many characteristics such as large storage space, ease of access and pay per use. It is strongly recommended by authors that cloud computing access should be provided to students in all educational institutions. Students should be motivated and hands on training should be provided to them. Authors also propose to conduct more seminars, workshops in public sector universities to utilize the benefits of cloud.

XI. RECOMMENDATIONS

It is recommended to conduct workshops / seminars to aware students with cloud computing in education, its uses and benefits to excel in the field of education not only in the university level as well as college and school levels to make understanding of this current technology to help in their education.

XII. FUTURE WORK

For the future, authors will find out the security and legal issue of cloud computing at in college and schools of different area along with the effectiveness of cloud computing and to aware the pupils with the usage of it.

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