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# Useful Ways that Cloud Computing can Support the Success of Education

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**ABSTRACT:** There are not many people in the education sector who are publishers or users. Cloud computing is typically exclusively connected to organizations and how they can maximize their operational efficiency. Let me restate the educational concept to briefly explain why the cloud is valuable to our educational system. Knowledge is its core. This understanding brings about progress, success, and accomplishment. Unfortunately, these criteria are unachievable due to several factors. But, this is an attempt at failure. The list is long and includes small classrooms, a dearth of supplies, personnel shortages, and insufficient teaching. Through cloud computing, educational standards and activities can be enhanced in one way or another. Reducing the issues above and increasing performance will be the outcome.

**KEYWORDS:** Cloud computing, web service, virtualization, grid computing, virtual computing labs, higher education institutions, and remote areas.

## I. INTRODUCTION

A significant portion of the attention of many societal groups, including government agencies, businesses, consumers, students, and researchers, has been drawn to cloud computing. A new buzzword, GIG data, emerged as human demands changed and made room for the digitization of information. The primary driver of cloud computing in the show is big data; every day, enormous amounts of data—enough to fill a PETA-sized disk—are uploaded to the internet, necessitating a large amount of processing and storage power. Cloud computing, sometimes called utility computing, offers customers software, platforms, and infrastructure as a service on a pay-as-you-go basis. The pay model involves obtaining anything. "Cloud computing, the long-held concept of computing as a utility, has the potential to alter a big section of the I.T. business, making software even more attractive as a service," according to industry polls about these services.

The educational system has steadily grown, and social workers are now the primary focus of instruction. From being teacher-centric to being learner-centric, education has changed. With the help of cloud computing, where you can get anything, Bloom's taxonomy [11] (multiple intelligence of learner) of teaching is now made simple. Teaching methodologies like chalk-and-board and in-person interaction have transitioned to the online world and are expanding faster than ever. The line tutor is an advancement in technology-based learning which assists students in attending classes at any hour. We need internet resources and e-learning in the educational setting. As knowledge has grown and modern society has become more advanced—many individuals are pursuing education—a variety of new issues have surfaced. For instance, when teaching approaches evolve, the current teaching-learning strategies cannot keep up with demand and require a significant amount of expensive infrastructure.

Additionally, the current teaching facilities must undergo ongoing renovations as education grows. Today's students want to stay up to speed with the rapidly evolving globe and keep up with their peers in this worldwide community. Cloud computing presents a fresh approach to creating a centralized, adaptable, open network education platform while lowering hardware input. The internet is the tool that will allow us to revolutionize cloud computing. It can provide teachers and students in even the most remote or economically disadvantaged school districts in the state with access to the most cutting-edge hardware, software, and instructional materials without requiring highly skilled I.T. personnel to be present. Simultaneously, it accomplishes more with a lot less, which is a welcome respite for school budgets that are already under pressure [12] IT businesses are keen to promote cloud computing use in education; for instance, Google Apps for Education Suite offers free and ad-free Google Mail, Calendar, Talk, Docs, Sites, and Video [1]. A Forrester cost research [9] states that Google Apps is a more efficient email system than Microsoft Exchange. According to a CSU study, it would cost \$9,774,000 per year in software licence, server hardware, and staffing to handle 50,000 users (the number of student email accounts at CSU) using Microsoft Exchange [2]. Google Apps for Businesses costs \$50 per user year, or

\$2,500,000 if there are 50,000 users. On the other hand, Google Apps Education Edition costs nothing annually [2].

In the example mentioned above, the educational institution's industrial cloud computing solution resulted in an expected savings of \$9,774,000 annually down to \$2,500,000 annually in the ROI for the "companies version" or to zero for equipment and license costs in the "educational version." From the last two examples, it is clear that educational institutions can successfully use both commercial and non-commercial cloud computing solutions. As an additional example, IBM launched IBM Cloud Academy, which offers a global platform for researchers, educators, and I.T. professionals in the education sector to pursue cloud computing initiatives, gain expertise, and exchange best practices for cutting costs while enhancing quality and accessibility to education. Using this, users can construct an effective network teaching platform without acquiring a server—instead, they need to purchase related "services" [10]. Academicians at universities who use cloud computing are unaware of its advantages and features that help them minimize costs. From the perspective of I.T. administration, it drastically lowers the expenses associated with resource management, such as electricity, cooling, and staff for system management, while increasing server and software license use, which reduces the need for purchases [12].

#### Benefits of Cloud Computing

High rate of return on investment (ROI)

Lower implementation and upkeep expenses

more mobility for workers around the world

Infrastructures that are both flexible and scalable

Quick time to market

I.T. department transformation (focus on innovation vs. Maintenance and implementation)

"Greening" of the data center

Increased availability of high-performance applications to small/medium-sized businesses [3]

## II. RELATED WORKS

The use of computers has drastically changed in the modern world due to the internet. People's addiction to computers extends to their online shopping and correspondence. The internet has undergone a significant transformation due to the cloud. This robust desktop application can be accessed via the internet and a database, making it accessible from any location at any time on any device. We are getting lucky with new inventions like e-learning and teacher-student online projects [10], among many others.

Improve economies of scale.

The biggest issue in the classroom is that students are afraid to ask questions or squander lecture time on things that can be done online. In addition to attending classes and using the online space, students can work on projects by communicating with their advisers. The teacher can draw attention to every kid who isn't shown interest, not only those who are overburdened. In this setting, students' abilities can be enhanced, and the workload can be decreased. Scale economies can benefit from this outside of the classroom.

Improve rapport and ease assignments.

In addition to implementing numerous technologies, many schools have already implemented computers. During the holidays, a lot of schools and colleges assign homework. With cloud computing, students can work together and complete assignments on a computer. This method not only saves time and increases student quality, but it is also efficient.

Easy access to education resources and effective sharing

Schools, universities, and institutes have benefited from the introduction of cloud computing. The concept is that pupils can communicate concepts that go beyond their own. The key benefit is that by offering all of these digitally, colleges can improve the quality of instruction while spending less on new hardware, software, and textbooks. This benefits the administration and the students by allowing them to learn more, improving academic growth and education quality. These are all excellent features. The management must, however, budget for their cloud computing expenditure.

### III. PURPOSE OF RESEARCH

In the age of e-learning 2.0, students can now learn outside of the classroom[11]. Enhancing the I.T. education environment could enable students to access learning materials anywhere. An excellent illustration of e-learning is the Indira Gandhi National Open University. Free software, such as word processing, spreadsheets, and presentations, can be used to build cloud computing services for I.T. environments like OpenOffice.org. Students can access the cloud computing service to learn with just a browser.

#### Example1

##### ENGINEERING INSTITUTE-Computer Lab

Every college has a computer lab, some of which are fully functional, but many universities lack the necessary platforms, software, and infrastructure because of a variety of issues that are best left unsaid. Because of this, cloud computing is crucial in enabling remote kids to get high-quality education via virtual computers. Consider a college with three computer laboratories connected to the cloud through the platform as a Service (PaaS) paradigm. However, students use a virtual connection to access their tools, run their programs, and store them on a server. In the worst scenario, the programs are safely stored even if the machine crashes because of a virus.

#### Example2

##### Microsoft Cloud Adoption Project (AICTE)

Microsoft Corporation India Pvt. Ltd. and the All India Council for Technical Education (AICTE) have teamed up to introduce cloud email services to all its institutes. Every institution can access Microsoft Office 365 for education as part of the cloud adoption process.

The following are included in O365 for Education, a free suite of tools for collaboration and communication:

Messaging Apps: Outlook calendar with 25 G.B. of online storage space and Exchange online with 10 G.B. of mailbox space per student with 18 M.B. of attachments (through Windows Sky Drive) Office web apps: Online help available to students and administrators around-the-clock for Microsoft Word, Excel, PowerPoint, and OneNote.

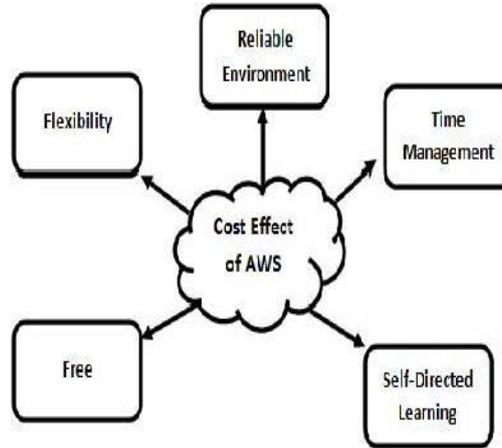
### IV. APPLICATIONS OF THE CLOUD IN EDUCATION

Cloud computing services for education are the most cutting-edge and quickly evolving aspect of technology and education, and they represent an expanding array of helpful online services. Additionally, it promises to offer several services that teachers, staff, and students will find quite beneficial [11]. It is vital to recognize that cloud computing can be a valuable addition to university education by providing immediate access to various scholarly resources, research applications, and instructional tools [12].

The field of education is rapidly embracing educational cloud computing due to the rapid development of new platforms, services, and applications.

Some researchers and students already use a particular cloud computing-based application and service. Additionally, these apps are making significant investments in cloud computing because they believe it will be the future of cloud computing in academia [13]. Microsoft, Google, IBM, H.P., Amazon, SalesForce, Amanda, and Zamanda are a few of these programs. A. Cloud Computing for Education on Amazon Amazon Web Services (AWS) provides free AWS usage for students enrolled in qualified courses through teaching grants, which help instructors teach cloud computing. With the funds' help, instructors can offer free usage to all students enrolled in courses that use AWS. Moreover, AWS offers academic institutions a highly scalable cloud computing platform with high availability, dependability, and flexibility to let staff, students, and researchers create various applications. Students and other users can request storage, processing power, and other services through AWS, giving them access to various elastic I.T. infrastructure services for educational use. Furthermore, AWS fits the definition of IAAS. This indicates that, in a remote location, Amazon offers virtual machine containers, high-performance networking, redundant storage, and basic computing capabilities [19, 20, 21]. AWS provides the following instructional services to teachers and students: Research scholarships for scholars utilizing AWS in their studies, Resource accessibility, 27 Teaching awards for faculty based on AWS Projects and tutorial grants for student organizations utilizing AWS for self-directed learning, Cost-effectiveness and efficiency in the institution's I.T.

Infrastructure As a result, the deployment and reliability of the educational infrastructure are managed by AWS,



as shown in Figure 1

Fig. 1. Cost effect of AWS

A) Amazon Cloud Services in Education: Amazon Web

Services are the most comprehensive cloud service available today, offering scalable computing power on the cloud. Its goal is to simplify web-scale computing for developers.

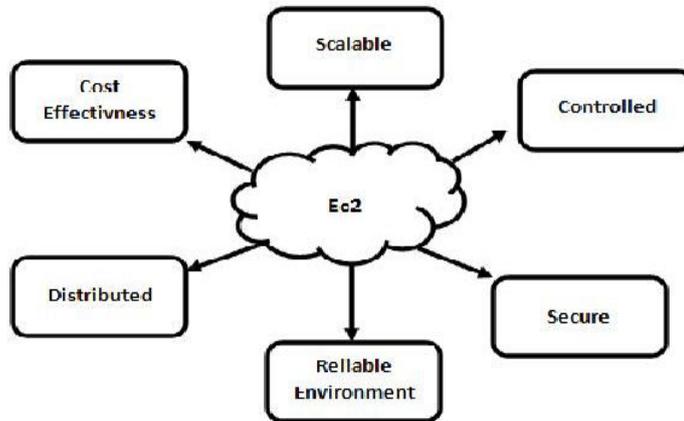


Fig. 2. Amazon EC2 Services

Among the many cloud services that Amazon provides is the Amazon Elastic Compute Cloud (Amazon EC2), a web service that gives institutional organizations access to virtual machines and additional CPU cycles. The services offered by Amazon EC2 are shown in Figure 2. Amazon Simple Queue Service (SQS): Provides various message-passing APIs to enable educators to communicate with each other. Amazon Simple Storage Service (Amazon S3): Enables researchers, faculty, and students to store items in Amazon's virtual storage that do not exceed a specific size. Amazon SimpleDB: A web service that allows users to run real-time queries on structured data sets in the cloud. Amazon Virtual Computing Laboratory (Amazon VCL): A free source implementation of a secure production-level on-demand utility computing for accessing a wide range of computational resources, storage, and software. The application of VCL is shown in Figure 3.

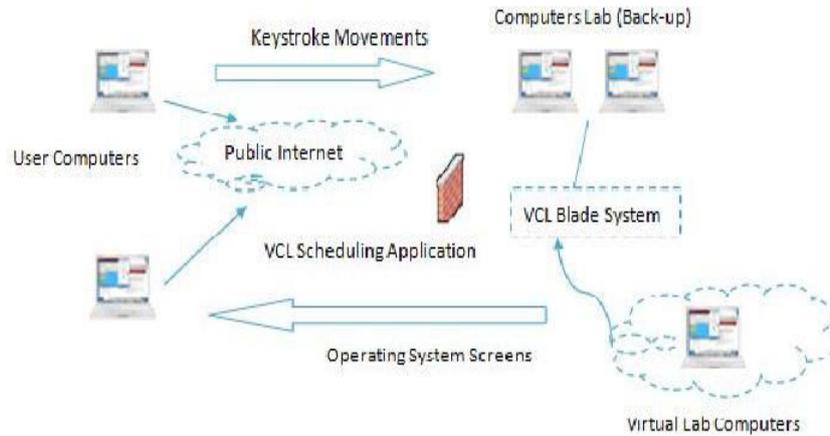
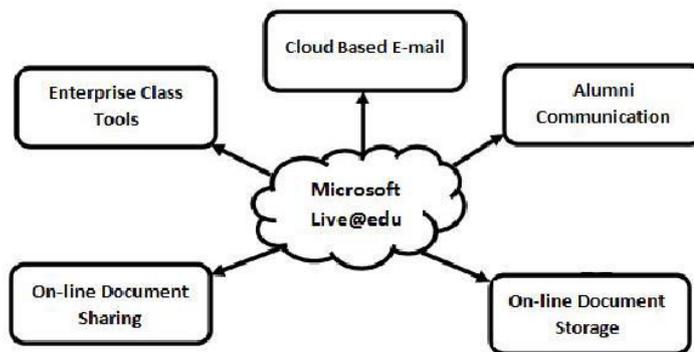


Fig. 3. Implementation of VCL

### Microsoft Education Cloud Computing

The power of choice is the focus of Microsoft's software and services strategy, which offers a hybrid model of resources that lets researchers and students move to the cloud. It also enables researchers to add Web-based services to their tangible I.T. assets and distribute workloads across infrastructures. Thanks to Microsoft cloud services, students and researchers can fully utilise the same Microsoft technology inside the educational institution [1]. Furthermore, all services enable cheaper costs for developing, scaling, operating, and migrating distributed systems between the cloud and data centre, giving educational institutions more financial freedom. Figure 7 illustrates the variety of needs that Microsoft Live@edu may fulfil.

Fig. 4. Features of Microsoft Live@edu



Microsoft Live@edu can be accessed via various widely used web browsers across different operating systems. It benefits I.T. departments and is free to use [2]: Reduces the expenses associated with I.T. infrastructure, including upkeep; Minimizes time spent on strategic initiatives and email system maintenance; Offers flexibility and fosters peer and faculty collaboration; Cuts down on time spent assessing risk and assisting in the formulation of well-informed decisions regarding the use of educational cloud computing. Raise the bar for students' performance and provide access to the newest technology wherever they are. 28 \_Free materials available on demand\_ Develop apps that multiple students can use simultaneously, and test and implement large-scale applications in various environments.

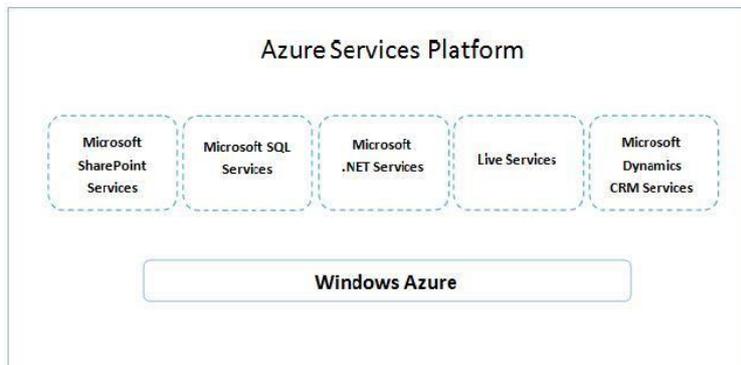
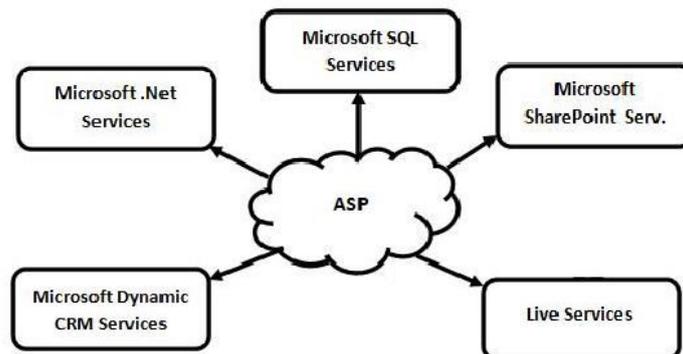


Fig. 5. Azure Services Platform

Windows Azure, an operating system that enables schools and institutions to run operating system applications and store data on Microsoft servers, is another name for Microsoft's cloud computing solution. Additionally, as seen in Figure 5 , the Azure Capabilities Platform (ASP) offers services that let academics, researchers, and students create user identities, control workflows, and carry out other tasks like using Microsoft's online computing platform . ASP is made up of various keys, as seen in Figure 6

Fig. 6 Key components of ASP



### Google Applications for Educational Cloud Computing

Faculty, researchers, students, and other users can operate Web applications within the Google Infrastructure thanks to Google App Education (GAE), a new generation of cloud computing-based Web application development platform. Universities, educational institutions, and the general public can access GAE for free [16].

With effective communication and sharing technologies, staff, students, and teachers may exchange ideas more quickly and complete tasks more effectively. In addition to productivity and collaboration tools like Google Docs Package, Google Apps Education Edition enables technical administrators to offer faculty, students, and staff a free collection of Web-based messaging tools like Google Mail, Google Talk, Google Sites, Google Video, and Google Calendar [17].

Google Applications for Educational Cloud Computing (GAE): GAE offers a variety of online tools and services that enable institutional schools to securely communicate and collaborate while allowing instructors, researchers, and students to select the solutions that best meet their particular needs.



Service	Service details
Support	Phone support
Application	3rd party applications
Video	Google Video
Cost 3	Google Video
Scheduling	Resource scheduling
Storage Enough Space	Enough Space
Users	No limit

Table I: GAE Services

Google Calendar: Google Calendar is a published, shared, integrated, and readily available calendar for class scheduling. Additionally, academic staff, researchers, and students can use the Google Calendar to arrange group projects and handle business.

Google Sites: Google Calendar allows academics, researchers, and students to use Google resources to construct, produce, and share content.

Google Video: With secure and private video technologies, Google Video enables educators, researchers, and students to share information.

Google Talk is a tool for instant messaging (I.M.) developed by Google. With limited conservation, colleagues can converse remotely via instant messaging.

Google Mail: In addition to allowing users to send and receive emails from various addresses, Google Mail also employs labels and filters to help researchers, teachers, and students manage the flow of incoming messages, organize their email, and receive mail from other accounts in their inbox.

Google Docs: Google Docs is considered the primary task tool of the course because it allows participants to collaborate synchronously on the same document.

#### IBM Cloud Services to Education

With IBM's new suite of cloud services, instructors, students, and researchers at schools, colleges, and universities can access programmers, computer lab materials, and services without requiring significant I.T. knowledge within those establishments. The IBM Smart Cloud for Education is a collection of cloud services and products intended to assist educational systems in using predictive analytics to obtain instantaneous insights into the performance of educators and institutions, improve the efficacy of researchers, and ease the burden on limited lab resources for instruction [10]. By utilizing IBM Smart Cloud for Education services, schools and higher education institutions can address the significant issues they face—student achievement, graduation rates, scholarship funding, and the need for I.T. resources for research. Educators can also take advantage of self-service reservations and seamless access to virtual computer resources on campus and the IBM public cloud, as shown in Figure 10.

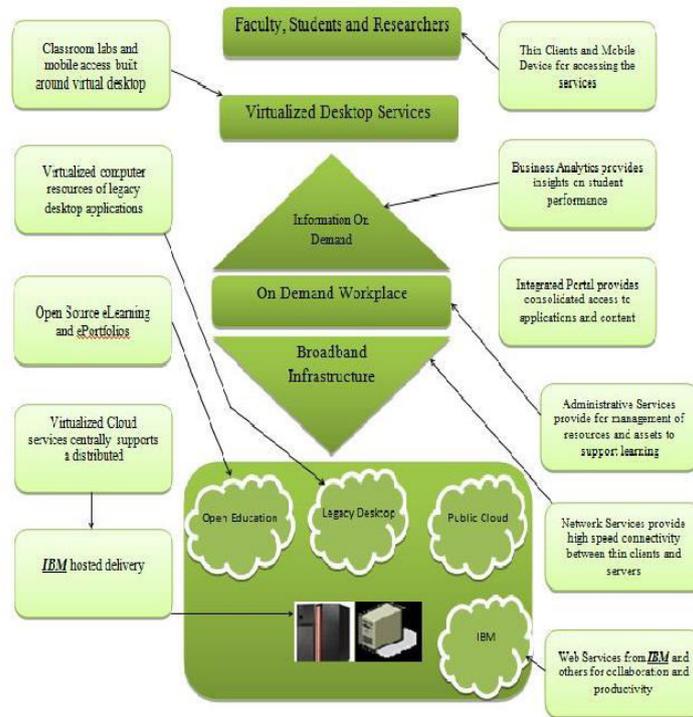


Fig. 7. IBM Cloud Computing Components for Education

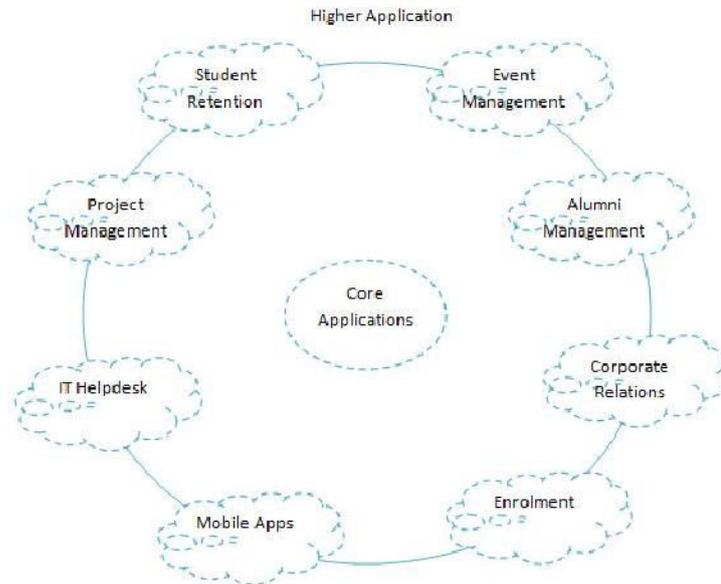
IBM Cloud Computing Services in Education: Students, staff, instructors, and researchers at educational institutions, colleges, and schools always ask for reliable, fast, and secure access to labs and computer resources. Nevertheless, despite financial limitations, establishing and maintaining the I.T. environment for this purpose might present several difficulties, including high prices and a lack of scalability to handle changing demand and quality of service issues. These issues can be helped with by cloud computing, which offers affordable access to the resources needed to satisfy the needs [9, 10]. Open/free source software and technical infrastructure that meet the demands of educational institutions can be supported by IBM Virtual Computing Lab (VCL) Solutions for Cloud, a component of the IBM Smart Cloud for Education. IBM offers ready-to-use tools for communication and collaboration between students, faculty, and administrative staff for learning beyond campus; IBM Tivoli Provisioning Manager for managing images and provisioning with VCL; IBM Global Business Services (GBS) for fast and secure VCL migration assistance; and IBM Smart Cloud services and resources for VCL private cloud users .

#### Salesforce.com Cloud Computing In Education

Salesforce is a well-known pioneer in educational institutions and a dependable leader in cloud computing and customer relationship management. The Salesforce.com Foundation offers educational institutions a significant discount on its products as part of its charitable endeavours. Higher education institutions of all sizes and in all industries use Salesforce to a) Work more productively, b) Increase constituent involvement, c) Measure and share impact and success, d) Work more cooperatively, and e) Deliver programmes and services in creative new ways. Because of its quick scalability, simplicity of configuration, and support for different functional roles, higher education institutions are adopting the Salesforce.com cloud computing platform. Essential Aspects Of Salesforce.com Cloud Computing For Teachers: As seen in Figure 8, salesforce.com can assist instructors, researchers, and students in managing their workloads more effectively while offering a variety of benefits . In the field of education, salesforce.com's salient aspects are:

Development of applications, b) cooperation among teams, c) analysis in real-time, d) mobile applications, e) marketing and recruitment, f) advancement, g) management of student records, and h) student tracking.

Fig. 8. Salesforce.com cloud computing in education



**H.P. Cloud Computing In Education**

H.P. ensures that researchers, faculty, and students get the most out of the cloud once the educators provide integrated support and service capabilities. H.P. services have the power to optimize several clouds and change the I.T. infrastructure. H.P. Building, running, and utilizing cloud computing in education allows educational resources like student data, knowledge management, faculty collaboration, and more to be available whenever needed. I.T. specialists and service providers in institutions like H.P. Cloud Computing's all-inclusive, integrated cloud solution delivered on a single platform.

H.P. Cloud Computing in Education: H.P. Cloud Computing Curriculum and H.P. Cloud System courses from H.P. Education Services help educators address their cloud needs. With award-winning online or face-to-face courses from H.P. Education Services, the students, faculty, and researchers can combine mission-critical computing with H.P. & heterogeneous management of their existing environment with H.P. Software. The characteristics of a cloud system in H.P. are as follows: a) True Integration, b) Complete management and automation, c) Security, and d) Scalability.

Cloud Map Of H.P. Education For Cloud Computing: H.P. Cloud System is the product of H.P.'s experience in delivering application management and Converged Infrastructure capabilities. It enables educational institutions to build and manage cloud services across private and public.

Clouds and traditional I.T. environments without knowing about H.P. Cloud System's infrastructure. The core of H.P. Cloud in education is illustrated in Figure 9.

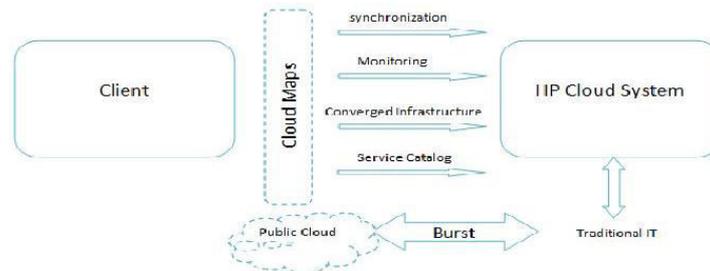


Fig. 9. The Core Cloud System in HP

#### AMANDA And ZMANDA Cloud Computing For Education

With a backup and additional features that enable quick installation, easy management, enterprise-class capability, and affordable subscription prices, Amanda Enterprise was created to meet these issues. Because Amanda Enterprise is an open-source backup and archiving programme, it solely uses standard formats and tools, preventing students from using a specific vendor to access their data. A remarkably easy-to-use and reasonably priced backup and disaster recovery solution is Zmanda Cloud Computing. Numerous products, including Amanda Enterprise, Zmanda Recovery Manager for MySQL, and Zmanda Internet Backup, have been targeted by backup and recovery solutions for educational institutions.

### V. RISKS OF CLOUD COMPUTING IN EDUCATION

While there are undoubtedly some significant potential advantages for organizations using cloud services, there are also difficulties for I.T. staff members who could be afraid of the effects of having their jobs outsourced. Before moving to the cloud, colleges and universities should consider the dangers and difficulties involved.

Among these dangers are, for instance:

**Cloud service failure:** Lack of funding and undeveloped markets may force some cloud providers out of business. Additionally, any decline in the quality of services provided and any loss of investment exposes universities and schools to the risk of having to fulfil their responsibilities, which may put them in violation of contracts or expose them to legal liability towards their staff, students, third parties, or even the general public.

**Compliance Regulations:** Educational institutions are implementing more unified and uniform compliance controls due to the growing number of regulations and operational transparency requirements.

**Data privacy:** Due to the cloud's multi-tenancy, reusable hardware and software profiles, and resilience from redundancy, there is a higher chance that institutions' private data will be deleted, partially erased, or subjected to denial-of-service assaults.

**Assurance to Service Provider:** This suggests relying on a specific cloud service provider for service setup, particularly when data portability is not enabled.

### VI. COMPARING THE CLOUD COMPUTING APPLICATIONS

Analysts in the computer industry have projected specific ways cloud computing will transform the sector as a whole. Cloud computing is anticipated to expand market, commercial, and productivity application prospects. The computing industry is transitioning to offering PaaS and SaaS for customers in academic institutions and businesses to have on-demand access by supplying the necessary capabilities whenever and wherever they are needed. This enables I.T. to reduce barriers and timelines associated with ideas for innovation to foster overall productivity and collaboration. Several scholarly and commercial institutions have recently begun researching and creating cloud computing infrastructures and technologies.

Based on some critical factors influencing a cloud computing platform, we compared educational cloud computing products in this section, including Amanda Network Backup, Google App Engine, Amazon EC2, H.P., Microsoft Windows Azure, IBM, and Salesforce in Table II. It is crucial to categorize the fundamentals of educational cloud computing apps according to the Platforms Supported, Languages Supported, Monitoring, and Support Services to understand the distinctions between these apps. Based on some critical factors influencing a cloud computing platform, we compared educational cloud computing products in this section, including Amanda Network Backup, Google App Engine, Amazon EC2, H.P., Microsoft Windows Azure, IBM, and Salesforce in Table II. It is crucial to categorize the fundamentals of educational cloud computing apps according to the Platforms Supported, Languages Supported, Monitoring, and Support Services to understand the distinctions between these apps.



Specifications	AMANDA NETWORK BACKUP	GOOGLE APP ENGINE	AMAZON EC2	HP	MICROSOFT WINDOWS AZURE	IBM	SALESFORCE
CI		API Standard	API Standard Command Line	API Standard Command Line	API Standard Command Line	API Standard Application/Control Panel	API Standard Web-Based Application/Control Panel
COS	Mac Linux/Unix Windows	Linux Windows Server 2008	Open Solaris Oracle Enterprise Red Hat Enterprise Ubuntu Linux Windows Server	Windows Server 2003 Cent O.S. Windows Server 2008	Windows Server 2003 Windows Server 2008	Enterprise Linux openSUSE Linux SUSE Linux Red Hat	Linux
PLS		Python JAVA	PHP JAVA Python WinDev	SASSQL RubyJava	Advanced Firewall Critical Data Privacy Secure Permission Persistent by	root access to the servers	Ruby JAVA PHP
Free Support	No	Yes	No	Yes	No	Yes	
FSF		Persistent nancy	Advanced Firewall Critical Data Privacy Custom/Secure Permissions Data Protection		Advanced Firewall Critical Data Privacy Custom/Secure Permissions Data Protection	Snapshot Backup Critical Data Privacy	Permissions Data Protection Failover Features Backup Storage Persistency
Monitoring			Yes. free	Yes. free		Yes, with a Charge	Yes, Free
Auto Scaling		Yes, Free	Yes, free	No			Yes, Free
Processor			32-bit64-bit	32-bit64-bit		32-bit64-bit	
Load Balancing		Yes,Free	Yes, with a Charge	Yes, Free			Yes Free
Year Founded		2008	2002	2005	2010		1999



Support Service	Phone White Papers Blog & FAQ Request Form	Online Resources Forums	24/7 Forums and Phone Online Guides and Resources	24/7 Forums	24/7 Forums and Phone Online Guides Resource s	Online and Phone Online Resources	Diagnostic Tools Forums Phone Online Resources	Knowledge Base Online Resources Phone
Support page	Web <a href="http://zmanda.com/">http://zmanda.com/</a>		<a href="http://aws.amazon.com/">http://aws.amazon.com/</a>	<a href="http://welcome.hp.com/">http://welcome.hp.com/</a>	<a href="http://microsoft.com/">http://microsoft.com/</a>		<a href="http://www-935.ibm.com/">http://www-935.ibm.com/</a>	<a href="http://salesforce.com/">http://salesforce.com/</a>

Table II: Characteristics of listed companies based on specification.

### VII. RELATED WORKS

There are numerous cloud computing systems available for use in education right now. Seattle is a free, lightweight, portable educational networking platform that uses donated cloud computing, as suggested by C. Justin et al. [1]. Students can study distributed systems and networking on computers dispersed throughout the Internet in Seattle. Seattle can also simulate peer-to-peer, cloud, and computing inside a fundamental region. A cloud computing architecture for education has been developed by S. Al Noor et al. [4] and is built on widely available resources throughout Bangladesh. This architecture can effectively and flexibly match the resources with the current economic condition by utilizing unused resources and the abstraction of third-party involvements.

Additionally, it can provide a more flexible environment, allowing the client to configure his security policy now. As N. Sultan [17] has shown, organizations and academic institutions are already reaping the financial, operational, and environmental advantages of cloud computing. Additionally, since many educational institutions will undoubtedly experience underfunding due to the global economic crisis, these places will likely adopt cloud computing.

### VIII. CONCLUSION

Simple devices like iPads, iPhones, and Tabs can solve the current issue of our nation's remote schools and educational institutions receiving technology to provide "equal and quality education to all," saving money on purchasing computing infrastructure, software licencing, and support staff. Cloud computing has a huge role in increasing the vast amount of high-quality educational content available to researchers and students in the "Big Data" era. Larger companies and the public sector, in particular, will benefit from cloud infrastructure's success and strong return on investment (ROI). The adoption of cloud computing by all those involved in education, together with significant backing from the government, is mainly responsible for its success in this domain. This essay discusses cloud computing for education and how colleges and other organizations already use it to their advantage in terms of cost, effectiveness, security, dependability, and portability. Numerous broad instances of cloud computing in education were given, including those from IBM, Microsoft, Google Apps, Amazon, and others. A case study of the applications was also presented and thoroughly examined.

### IX. CONTRIBUTION TO RESEARCH

We are still in the early stages of the cloud computing revolution in education. Current research describes several excellent and successful educational and research products, focusing on the analytical features of cloud computing applications. Only a few practical uses of cloud computing models in academic settings have been assessed. This paper initiates a process by methodically combining the diverse interpretations of cloud computing in education with the numerous approaches to cloud computing implementation. As a primary outcome, this article elaborates on the streamlined service structure and uses of cloud computing for education, including the features of the educational platform and its adaptability to all colleges, universities, and educational establishments. This study also offers several educational applications for the infrastructures for education that have been put in place for use in the academic area. Cloud computing in education will address issues from a scholarly perspective, including cost savings, efficient communication, security, privacy, flexibility, and accessibility.

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