

Cloud Computing in Education

J S Ananda Kumar, A. Sreelatha, A. Sowjanya

Abstract - Cloud computing is not just a buzz-word, it represents a strong direction of IT industry development. Speaking of cloud computing we should distinguish three different service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). The scope of this work is a model of Software as a Service. This represents the lease of computing resources on a network of remote servers where applications are executed and data is stored. The application of cloud computing is very broad and growing daily because of many advantages to the users, and is driven by the increasing use of various mobile devices (laptops, tablets and Smartphone) and mobile Internet access being more available. Cloud computing is applicable in education, but it implies the acceptance of these services by all involved in the educational process. Therefore, the aim of this paper is to investigate whether there is a need between our students for applications and services in the "cloud" (SaaS), the extent to which they use them and what types of applications and services are leading. The paper analyzes and interprets the results of this study which provides indications of students' willingness to "move to the cloud".

Keywords: cloud computing, SaaS,PaaS,IaaS, education, students

1 Introduction

The classroom is changing. From when the school bell rings to study sessions that last well into the night, students are demanding more technology services from their schools. It's important not only to keep pace with their evolving needs, but also to prepare them for the demands of the workplace tomorrow.

At the same time, education institutions are under increasing pressure to deliver more for less, and they need to find ways to offer rich, affordable services and tools. Those educators who can deliver these sophisticated communications environments, including the desktop applications that employers use today, will be helping their students find better jobs and greater opportunities in the future.

Cloud computing can help provide those solutions. It's a network of computing resources—located just about anywhere—that can be shared. They bring to education a range of options not found in traditional IT models. In fact, the integration of software and assets you own with software and services in the cloud provides you with new choices for balancing system management, cost, and security while helping to improve services.

What's in the cloud? Much of what's on your desktop or in your data center right now. For example, e-mail in the cloud is, in many cases, free for schools and universities that need to upgrade

legacy systems and expand services. The cloud helps ensure that students, teachers, faculty, parents, and staff have on-demand access to critical information using any device from anywhere.

As you plan your long-term, data center strategy, your institution can benefit from opportunities in the cloud.

2 CLOUD COMPUTING IN EDUCATION

According to [5], „the potential of cloud computing for improving efficiency, cost and convenience for the educational sector is being recognized by a number of US educational establishments. For some universities, the availability of an awesome computing power through cloud computing for research purposes was welcome“. „Many educational institutions have begun their movement to cloud computing by outsourcing their student email provision ... Educational institutions are also beginning to use lower level cloud services for purposes such as data storage. This may be attractive where data security is of lower concern such as where video and audio is provided as open educational resources. Another use of cloud computing which is beginning to emerge in education is for the hosting of institutional learning management systems (LMSs) in the cloud. Outsourcing the provision of LMSs such as Blackboard or Moodle to a third party makes sense for institutions who cannot justify the costs of purchasing, maintaining and supporting the

hardware and software themselves“ [2]. Cloud computing is often associated with e-learning and m-learning [4]. This refers to e-learning environment mainly distributed on the cloud, in which Open Educational Resources were produced, researched and shared by participants worldwide [3]. With applications in the cloud (SaaS), students and teachers can flexibly access their data via a web browser from a computer at home, school, library, student room or some other place, and achieve rapid and efficient communication, collaboration, exchange or share documents, contacts, notes, audio / video and other data. With their use students can create „CloudBased Personalized Learning Environment“ (Figure 1) [1]. "The first idea that comes to mind when assessing such a cloud space for learning, would be the creative potentials that could be nurtured i.e. the endless ideas, thoughts and knowledge that could be shared, created and inspired" [3]. In addition to individual applications in the cloud, bundled applications are also available (eg. Google Apps for Education or Microsoft Live@edu with Office 365 and other applications for Education) that combine tools for communication and collaboration, office tools for working with documents, and space to store and synchronize data on demand. „Whereas a university computing service department may aim to achieve 99.5% availability for its educational services such as the LMS, Google offers 99.9% availability for its educational application suite and appears to outperform this target „ [2].

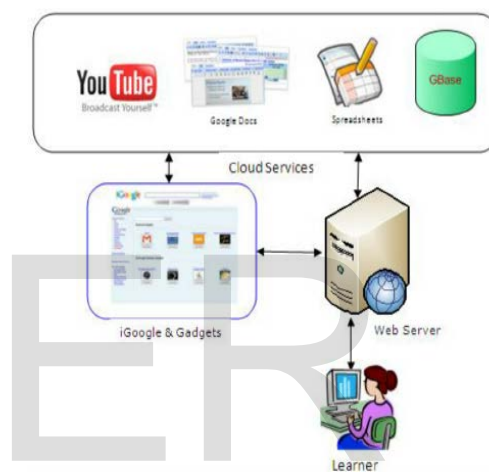
*A.Sreelatha, Dept. of MCA 2nd year, KMMIPS, Tirupati,
mail id:adhurisree@gamil.com.*

*A. Sowjanya, Dept. of MCA 2nd year, KMMIPS, Tirupati,
Mail id:adhurisree@gamil.com.*

*J S Ananda Kumar, Assistant Professor, Dept. of MCA,
KMMIPS, Tirupati, mail id: jsanandkumar@gmail.com.*

Using services and applications in the cloud, students and teachers can achieve mobility because their educational resources and necessary applications are available via portable computers and Internet connected devices. For example, classes can be implemented outside the school / faculty or students can perform duties at various places.

Figure 1 Example of Cloud-Based Personalized Learning Environment



2.1 Cloud terminology

Services include software and hardware, from e-mail to entire IT platforms, which are hosted in the cloud. This means that someone else makes them available to you on demand—that is, when you need them. Service capacity is controlled in the cloud and is dynamic and elastic: Computing resources are allocated and deallocated as demand changes.

2.2 Cloud compliance

Cloud services comply with relevant statutes, such as the Health Insurance Portability and Accountability Act of 1996 (HIPAA), the Family Educational Rights and Privacy Act (FERPA), and the Schools Interoperability Framework (SIF).

2.3 Defining the cloud

Clouds in nature may appear loosely defined, but at the National Institute of Standards and Technology (NIST), cloud computing means the following:

- On-demand service. You can get what you need when you need it.
- Broad network access. The cloud brings network-based access to, and management of, software and services—meaning access is anywhere, anytime.
- Resource pooling. A large pool of users shares location-independent resources and costs in an environmentally sustainable way.
- Flexible resource allocation. As demands fluctuate, cloud services can scale rapidly. You don't have to worry about bringing new servers online or reallocating resources.
- Measured service. Most cloud usage is metered, often per user or per hour. With those services, you pay for what you use. Microsoft offers Microsoft Live@edu, a free option designed specifically for education institutions

3 Which cloud is right for you?

The choice to move to the cloud is not an all-or-nothing proposition. With different types of cloud offerings, you have flexible options about which services to obtain in the cloud and which to keep on-site. Your priorities and security requirements determine the level of cloud capabilities to explore.

If you look closely at the cloud, you'll see three distinct sets of offerings:

- Software as a Service (SaaS): The applications, such as e-mail, people use everyday.
- Platform as a Service (PaaS): The operating environment in which applications run.

- Infrastructure as a Service (IaaS): The on-demand data centers.

Outsourcing some capabilities to the cloud makes the most of what's on-site by freeing time, budget, and people. For example, with SaaS, you can add services, like e-mail, affordably. With PaaS, you can deliver services broadly without having to manage the infrastructure. With IaaS, you get pay-as-you-go data center capacity for adding CPUs, storage, networking, or Web hosting.

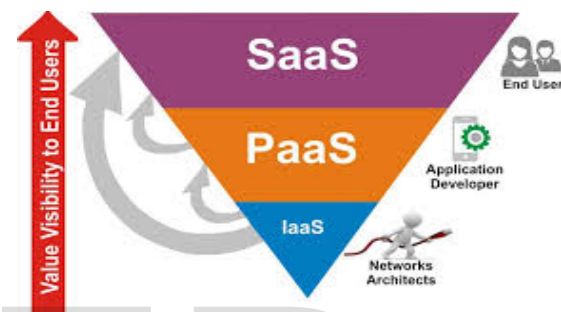


Figure 2 The three general types of cloud services: SaaS, PaaS, and IaaS

3.1 Anytime, anywhere apps: SaaS

The cloud hosts the applications you use every day for productivity, contact management, payment processing, and more. In the current and future economy, SaaS makes sense. It can lower expenses associated with software acquisitions in the near term. Longer term, it helps organizations with limited IT resources to deploy and maintain needed software in a timely manner while, at the same time, reducing energy consumption and expense.

A growing number of academic institutions are turning to SaaS for their desktop applications. For example, Hinds Community College uses an e-mail solution hosted in the cloud. Students now have the free collaboration tools they want, people on campus have the tools they need to work together, and administrators are finding it easier and more cost-effective to manage.

3.2 SaaS for education: Microsoft Live@edu

The workplace is changing, and the desktop applications that employers use today will evolve to desktop applications combined with Web services tomorrow. Educators preparing tomorrow's workforce want to partner with companies that can give them affordable access to those tools today.

Microsoft Live@edu is a program that provides students, staff, faculty, and alumni long-term, primary e-mail addresses and other applications that they can use to collaborate and communicate online—all at no cost to education institutions. Students will be using Microsoft products similar to those used in many workplaces that help to prepare them for jobs after college.



Figure 3 Education of Cloud in SaaS

3.3 Platforms in the cloud: PaaS

The scalable architecture of the cloud is transforming how academic institutions think about how they serve their students, teachers, faculty, and staff. Size—of your service, budget, or staff—does not limit IT when the platform for custom services is as readily available and broadly deployable as the Web. Cloud platforms free you to focus on the services you can offer without worrying about or managing the infrastructure needed for those services.

PaaS is the operating environment of the cloud with the tools you need on demand to create and host online services, software, Web sites, and mobile applications. With PaaS, you can concentrate on delivering applications rather than on the underlying infrastructure, which a service

provider maintains and updates in its data centers. You can also use PaaS to create multi-tenant applications—that is, services accessed by many users simultaneously.

With PaaS, you can develop new applications or services in the cloud that do not depend on a specific platform to run, and you can make them widely available to users through the Internet. PaaS delivers cloud-based application development tools in addition to services for testing, deploying, collaborating on, hosting, and maintaining applications. The accessibility of PaaS offerings enables any programmer to create enterprise-scale systems that integrate with other Web services and databases—an aspect of cloud computing that fosters additional opportunities for education IT and allows bigger thinking.



Figure 4 Education of Cloud in PaaS

The open architecture of PaaS can support integration with legacy applications and interoperability with on-site systems—important considerations because education operates in a mixed IT world. Interoperability gives you the flexibility to take advantage of cloud benefits while retaining data and applications on-site as needed.

3.4 Data centers on demand: IaaS

How many data centers does it take to run a K-12 or higher education institution? Now that the cloud offers storage, networks, and servers as a service, technology is no longer bound by the traditional on-site IT department. On-demand data

centers put virtually unlimited computing power into the hands of even the smallest education institution.

On-demand data centers—also known as IaaS—provide compute power, memory, and storage, typically priced per hour according to resource consumption. Some call IaaS bare metal on demand. You pay for only what you use, and the service provides all the capacity you need, but you're responsible for monitoring, managing, and patching your on-demand infrastructure. One big advantage of IaaS is that it offers a cloud-based data center without requiring you to install new equipment or to wait for the hardware procurement process. This means you can get IT resources at your school, college, or university that otherwise might not be available.

With IaaS, savings come from hardware and infrastructure costs but not necessarily from staffing because you are still responsible for system management, patch management, failover and backup, redundancy, and other system management tasks. Depending on the service, an IaaS provider typically handles load balancing, monitoring, and scaling automatically, and you manage your cloud deployments.



Figure 5 Education of Cloud in IaaS

4 Security in the cloud

Education institutions are entrusted with confidential information and private data. Cloud computing may seem risky because you cannot secure its perimeter—where are a cloud's boundaries? In

addition, these institutions must comply with regulatory statutes, such as FERPA and HIPAA, and should support education standards, such as SIF.

NIST likens the adoption of cloud computing to wireless technology. Institutions learned how to protect their wireless data as they moved forward—and they will do the same with cloud computing. In building its solution, Aga Khan University in Pakistan found that cloud computing helped strengthen security and improve protection against viruses, resulting in 66 percent reduction in calls to the IT department.

5 Cloud benefits for education

How can the cloud help you transform education? Consider the following:

- Flexible services. Drive innovation with data services in the cloud that students, teachers, faculty, and staff can reuse. Offer your own data mashups on a portal.
- Infrastructure. Get all the IT resources you need, only when you need them, managed securely and predictably. And pay for only what you use. Any budget constrained institution has to like that.
- Applications and content. Rather than waiting in the software procurement line, get hosted software, datasets, and services so fast you'll have plenty of time to work on your mission.
- Policies and regulations. Proceed carefully, but note how cloud computing can help you meet your institution's compliance requirements.
- Creative IT. Free your IT department from a keep-the-lights-on approach to foster some creative problem solving that can help teachers better engage their students.

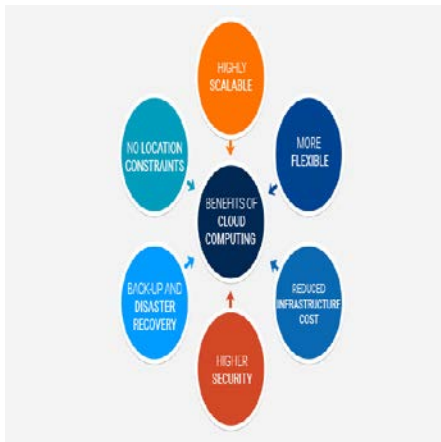


Figure 6 Cloud benefits for education

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6 CONCLUSION

The cloud allows us to access our work anywhere, anytime and share it with anyone. It frees us from needing a particular machine to access a file or an application like a word processor or spreadsheet program. In the present paper a cloud education system is introduced and how it is beneficial for students, faculty and the educational institutes for providing quality education.

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