ORIENTAL JOURNAL OF COMPUTER SCIENCE & TECHNOLOGY
An International Open Free Access, Peer Reviewed Research Journal
Published By: **Oriental Scientific Publishing Co., India.**
www.computerscijournal.org

ISSN: 0974-6471
September 2013,
Vol. 6, No. (3):
Pgs. 369-376

Cloud for Education: The Challenges of Current Reign

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(Received: August 05, 2013; Accepted: August 25, 2013)

ABSTRACT

Sighting towards the current scenario of modern era's Higher education the scene is quite changing and widespread, extending within the reign of cloud computing only, campuses are now leveraging with mobile apps, smart phones and highly customized devices. And at the same time, the amount of data and content that are to be maintained and stored has gone from a nibble to what could now only be described as a flood. This add-ons complexity and cost. Beside these challenges, there is increasing demands for transparency, governance, and data-retention regulations are pointing to the "big data" problems faced by higher education. Therefore an unassailable shared service solution is now becoming a need for hour in this every second updating arena, the IT and computing leaders in higher education and research are wondering for it to integrate from already spread out lots of agile services from cloud. And the next battle will be in the area of architecture that provides services and applications according to a specific institution as "above campus" into cloud service that must be chosen with care to identify and deliver centrally or locally to persist a unique infrastructure from others in a row. And also investigating the standards and current cloud technologies such as content management framework for the above stated issues to consolidate and centralize a common service framework across disparate institutions of higher education and research and common services that can be used by all. This paper presents the role of cloud computing in the provision and support of up gradation and development in higher education that yield tools that meet the demands of the next generation campus society. Furthermore, we present integration components framework transformation in the development of higher education with cloud computing as an appropriate alternative support. And investigating the Interpretability standards currently available for higher education, the challenges and their possible solutions.

Key words: Infrastructure, Interpretability computing

INTRODUCTION

The current era of IT is witnessing revolutionary impact of cloud Computing and so as the field of education is also feeling its influence at a larger extends .Right from the ICT to Community Research and Development Information Service – CORDIS to today's well known network of Linked Up Linking Web Data for Education Project so that the universities and research will get benefitted by the widespread data on the web using some evolutionary framework. While getting back to ICT play a major role in setting up the path for these new services facilitating the

education scenario giving it a new face by overtaking the problems like heavy budget for updating every now and then, on-campus computing resources shortages, problem of unified storage media, and applications scattered around campus computers, lack of agile skill professionals and resources for practical knowledge .With the expanding domain of commercial cloud computing it is not a concept anymore for educational campuses as it already altered the surroundings and lives by the use of hi-tech mobile, smart phones and tablets. Now by the commercialization of cloud market for education provides a long range of applications for campuses as well as students gadgets. The cloud provides some of the crucial issues as benefits such as virtualization of capital assets like disk storage and processing cycles so that the information and communications technology costs will be lowered down as it is now readily available at an affordable operating expenses thus provides a solution for cost cutting. Work already done in this field suggests the many benefits cloud computing services provides to universities and research organizations as well as pin points the limitations like security, privacy, data communication, migration tradeoff and many others before going to adopting it for campuses to harness it completely.

Beyond cost-per-IT-unit benefits, however, these very high speed digital networks and cloud computing models renew important questions regarding the role of a particular institution among the community of scholars and students that compose higher education.

This paper will provide a current overview of how cloud computing nowadays affecting the higher education. The intent is to first give an overview of cloud computing to those are new with the concept by presenting its definition, essential characteristics, services and deployment models by NIST. In the past few decades the concept of "cloud computing" has emerged as an agile and promising solution for the limitations like decreasing IT budgets and increasing IT needs. According to the latest trends for 2013 in education Industry Gartner, Inc. (NYSE: IT) the world's leading information technology research and advisory company states that.

NIST Cloud computing

Definition of cloud computing by NIST[1]

"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction".[1]

Five Essential Characteristics[2]

This cloud model is composed of five essential characteristics. [2]

1. On-demand self-service. A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
2. Broad network access. Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).
3. Resource pooling. The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth.
4. Rapid elasticity. Capabilities can be rapidly and elastically provisioned, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.
5. Measured Service. Cloud systems

automatically control and optimize resource use by leveraging a metering capability1 at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

Three Service Models[2]

Cloud Software as a Service (SaaS)

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a Web browser (e.g., Web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

Cloud Platform as a Service (PaaS)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or -acquired applications created using programming languages and tools supported by the provider.3 The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations.

Cloud Infrastructure as a Service (IaaS)

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, deployed applications; and possibly limited control of select networking components (e.g., host firewalls).

Four Deployment Models[2]

1. Private cloud. The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.
2. Community cloud. The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.
3. Public cloud. The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.
4. Hybrid cloud. The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds)."

Cloud for education

It's not new to talk on the possibilities cloud is having for Education, already a lot of work is going on in this field to make it more flexible, scalable. The maturity of standards throughout, the availability of high performance network capacity, and the emergence of virtualization technologies are combining to enrich the sourcing options at usage.

One report by McKinsey & Co. Writers like Nicholas Carrargue that a so-called big switch is ahead, wherein a great many infrastructure,

application, and support tasks now operated by enterprises will—in the future—be handled by very-large-scale, highly standardized counterpart activities delivered over the Internet. The prospect of a maturing cloud of on-demand infrastructure, application, and support services is important for educational institutions as a possible means of [4]:

- Driving down the capital and total costs of IT in higher education.
- Facilitating the transparent matching of IT demand, costs, and funding.
- Scaling IT.
- Fostering further IT standardization.
- Accelerating time to market by reducing IT supply bottlenecks.
- Countering or channeling the ad hoc consumerization of enterprise IT services.
- Increasing access to scarce IT talent.
- Creating a pathway to a five nines and 24 × 7 × 365 environment.
- Enabling the sourcing of cycles and storage powered by renewable energy.
- Increasing interoperability between disjoint technologies between and within institutions.

The transformation needs a new set of it leadership skills.

There was universal agreement that to manage an IT infrastructure, service portfolio, and support environment that are sourced above and below campus will require a set of skills that is not usually abundant in the higher education IT community.

Now in this new "age" of provisioning IT services are need of the hour, a new set of skills is needed in our community. Contract management, SLA management, and the management of policy and regulatory compliance in third parties are just a few of these skills. Organizations like EDUCAUSE (information technologists), NACUBO (business officers), NACUA (attorneys), ACUA (auditors), and others will need to develop and deploy a curriculum to meet this important challenge. [4]

Cloud computing in universities today

Some Illustrations

Email

What makes cloud computing a relatively new phenomenon in the education sector is that, in the past, institutions would own, control and provide computing capabilities at all levels. For example, email typically ran on a server owned by the college, that sat in a college building, hooked up to the rest of the college's network, tended by college employees, using software licensed by the college for the benefit of its students and staff[5]:

Software	College	College
Platform	College	College
Infrastructure	College	College

With a cloud computing solution to email such as Google Apps for Education **8** or Microsoft's Live@Edu **9**, this picture changes considerably[5]:

Software	College	Google/ Microsoft
Platform	Google / Microsoft	Google / Microsoft
Infrastructure	Google / Microsoft	Google / Microsoft

Provision Ownership

The server, buildings, network infrastructure in cloud computing case are all owned and provided by a third party. The College still provides email to students and staff, but it no longer licenses email software directly, or has employees looking after the service beyond hooking the external email system up to the local infrastructure.

Customer Relationship Management

Cloud computing also enables different parties to share effort in interesting new ways. For example, Enrollment Rx **10** offers student enrollment management as Software as a Service to institutions. In turn, Enrollment Rx is built on the Platform as a Service offered by force.com **2**, a company that offers generic Customer Relationship Management (CRM) as SaaS, but also allows others to build specialized CRM applications on its own platform. The whole picture looks like this[5]:

Software	Enrollment Rx	Enrollment Rx
Platform	Force.com	Force.com
Infrastructure	Force.com	Force.com

Provision Ownership

Note that Enrollment Rx**10** is providing the platform to the institution, not the institution to its staff or students.

Content transcoding

Platform as a Service offering also make it easy to try out new services without major investment. At JISC CETIS, for example, a need to be able to convert between different educational content formats was identified. In order to be able to meet an unknown amount of demand, and to enable the developers (Knowledge Integration ltd **11**) to develop and deploy a service rapidly, the new application was developed as a service that runs on Amazon's web services:

Software	JISC CETIS	JISC / HEFCE
Platform	Amazon.com	Amazon.com
Infrastructure	Amazon.com	Amazon.com

Creative Cloud Offerings for Education

On May 6, 2013, in addition to announcing enhancements to the Creative Cloud program, Adobe stated that the company will discontinue future development of the Creative Suite. The current Creative Suite (CS6) is the last Adobe will produce. All future development and delivery of Adobe's Creative apps will be via Creative Cloud that includes the next generation of Adobe desktop applications—including Adobe Photoshop® CC, InDesign® CC, Illustrator® CC, Dreamweaver® CC and Premiere® Pro CC. Adobe's desktop tools, previously known as Creative Suite (CS), are now branded CC to reflect that they are an integral part of Creative Cloud and have been reinvented to support a more intuitive, connected way of creating. Adobe Creative Cloud includes more than 30 tools and services that enable professional grade content creation and delivery across print, web, mobile apps, video and photography. With this announcement, Adobe would like to inform our education community of important updates to our business policies and purchasing programs and Adobe has launched a new licensing option for primary, secondary, and higher education institutions. The EEA is an easy-to-manage, term-based licensing program that gives educational institutions access to new versions of Adobe® Creative Cloud™ desktop applications. With this program, your department or institution can have the creative tools it needs to be more productive, foster creativity in teaching and learning, and help students develop essential digital communication skills. Individuals as well as institutions can get access to the latest Creative Cloud desktop applications and services. The following membership offers are available:

- Creative Cloud for individual—for individual use by students and teachers.
- Creative Cloud for teams—ideal for small work groups, but is not a solution for computer labs or classroom implementations.
- Creative Cloud for enterprise—provides the best coverage model for institution-wide access to CC apps and services and is available through an Enterprise Term License Agreement (ETLA) with Adobe.
- Creative Cloud desktop apps—gives institutions access to CC apps under a term license. The CC apps can be purchased through Adobe's new Education Enterprise Agreement (EEA).

Risks and opportunities

Moving significant issues of an institution's IT systems to third parties can enable a lot of flexibility and efficiency, but also has consequences in a number of areas that require some considerations.

Risks

Interoperability

As with conventional software, there is a danger that communicating with a cloud computing application or platform is specific to only one supplier. Such proprietary standards make moving one's data or software from that supplier to another difficult.

Fortunately, independent implementations of popular Platforms as a Service such as Google's App Engine already exist, which provides one way out of vendor lock-in. Also, some organisations are developing open standards for cloud computing, which could inspire participating vendors to compete on openness rather than lock-in.

Security

Any cloud computing solution, by definition, processes an organization's private data on shared systems, and that data is generally transported to and from the cloud over the internet. This naturally raises some concerns about the total security of any given cloud computing service. Reasonably robust technical solutions to the issues exist, but it is still clear that a lot relies on the degree of trust between the institution and the cloud computing vendor. For that reason, many institutions try cloud computing solutions with non-critical data first.

Reliability

In principle, the economies of scale involved should mean that cloud computing vendors have more to invest in multiply redundant, fail-proof systems than most colleges. Still, a number of well-public ised cases have shown that large platforms can still fail. Strong Service Level Agreements (SLAs) can help manage, but not eliminate the issue. It could well be the case that failures become much rarer as the cloud computing approach matures- vendors have a powerful incentive to keep their products going.

Legal issues

Certain types of data, particularly those relating to students, are prohibited from travelling out of the institution's jurisdiction. Archetypal cloud architectures are not geographically determined; resources go to whichever datacenter is available and capable. Because of legal concerns, however, vendors are starting to be able to give some guarantees that, for example, no data will leave the EU.

Private clouds

One way of mitigating some of these concerns is the idea of a 'private cloud'. In most cases, these are effectively a variation of institutionally owned and run IT systems, configured to run like cloud services. To what extent these are re-badged traditional enterprise products remains to be seen.

Opportunities

Dealing with peak demand

Events such as clearing in August or enrollment in September can place a significant strain on IT infrastructure. Buying in-house capacity to deal with such a peak means that expensive systems are under-utilised the rest of the year. Computing capacity that can be rented quickly and flexibly has clear advantages in this regard.

Cutting costs

The fundamental driver for cloud computing remains price. In that sense, the underlying principle is simply economies of scale. It should cost less per unit to provide a service for many organisations, than it is for the organisation to provide for itself. Though the cost of hosting common functions such as email in-house is marginal for some institutions, an increasing number of surveys do show that cloud solutions can bring savings.

Catering for specialised needs

The economies of scale principle also suggests that cloud computing may make services viable that are not economical on an institutional scale. The content transcoder above is one example, but many other services are conceivable whose running costs or investment risk can't be justified by known demand within one college, but would work 'web-wide'.

Separation of concerns / focusing on one's strength

More strategically, cloud computing can provide an opportunity for information system departments to reconsider their role. In a time when there are an ever increasing number of technologies and demands to use them, the idea of focusing on some core functions can be quite attractive. As we've seen, cloud computing solutions allow both mundane and generic systems such as file storage, as well as more cutting edge and specialised functions to be managed by others.

Cloud computing

Available products and services

The range of cloud services is expanding rapidly, particularly those that are offered as Software as a Service to the end user, but are themselves built on Platforms as a Service. Add to that the fluid boundary between Infrastructure as a

Service and traditional hosting solutions and the list of potential products becomes unmanageable. Still, the following products and services are either already in use in Further and Higher Education, or illustrate the principles particularly well.

Microsoft Live@edu

A free Microsoft solution that provides email, file storage and a number of other collaboration tools as Software as a Service. At least four different UK institutions are currently piloting the service with undergraduates. A number of technical integration features are available, most notably the ability to brand email addresses with the institution's name (i.e. joe@poppleton.ac.uk, not joe@microsoftlive.com). http://www.microsoft.com/liveatedu/

Google Apps Education Edition

Offers pretty much the same features as Live@edu, but with the addition of the Google docs office applications. Integrations features are comparable too, and it's also free.
http://www.google.com/a/help/intl/en/edu/index.html

Enrollment RX

Is a relatively small company in the US that offers a Customer Relationship Management solution as Software as a Service. The service allows institutions to track prospective students through the application and enrollment process. The system is not free, but the combination of web delivery on the user end, and Platform as a Service at the back end, are intended to keep prices competitive.
http://www.enrollmentrx.com/

Google App engine

Is a Platform as a Service product that allows developers to develop and deploy web oriented applications. Compared to traditional software development, the platform provides a number of commonly used functions that the developer no longer needs to worry about, and the often time-consuming deployment configuration can be streamlined or skipped. It also allows people to skip the capital investment in infrastructure that's normally required for new web application, and just pay for what's used.
http://code.google.com/appengine/

Amazon Web Services

Is comparable to Google's App Engine, but more of a family of lower level, differentiated functions. The Simple Storage Service (S3), for example, only does storage of data, and the Elastic Compute Cloud (EC2) only computing cycles. This approach allows for a degree of flexibility that's proven popular with many developers.
http://aws.amazon.com/

Slicehost.com

Provides Infrastructure as a Service, and is technically a bit more like traditional co-hosted hosting than Amazon Web Services, but more flexible and can scale quicker to meet demand than such hosts.
http://www.slicehost.com/

CONCLUSION

Cloud services provide the opportunities to the educationalist to the providers and to the one who utilize it in higher education and research institutions, to take over the revealing education system and the traditional practices and consider again which services are needed especially online tools and techniques or the best way to deliver those services in order to save time, money, effort and to be updated which are a mandatory factor in education system as the tutor must be aware so that the pupil will also get update information with the latest techniques. Now a Days Most of the services are readily available in the public cloud. Some services need to be procured through the institution's IT department. Only a few services will require custom development. The final result will most likely be a loosely coupled, customized arrangement consisting of off-the-shelf systems and services based on proven technology. Several CIO's have predicted right that higher education institutions are now out of the game of running the monolithic enterprise systems and trying to move the finance, human resources, and student systems into the cloud. But of course there are issues also with the umbrella of possibilities.

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