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Using of Cloud Computing in Education

Hanan Qassim Jaleel
Baghad College of Medical Science, Baghdad, Iraq

Abstract:
Cloud Computing is a versatile technology that can support a broad-spectrum of applications. The low cost of cloud computing and its dynamic scaling renders it an innovation driver for small companies, particularly in the developing world. Cloud deployed enterprise resource planning (ERP), supply chain management applications (SCM), customer relationship management (CRM) applications, medical applications and mobile applications have potential to reach millions of users. Cloud computing is a buzzword now days. It has changed the whole scenario. cloud computing being "on demand" following in line with other "utilities", such as electricity and telephone .Not even the business organization and several educational institutions have been considering and some of them even adopting cloud computing strategies in order to meet their requirements. Cloud computing services are a growing necessity for business organizations as well as for educational institutions. Although there are still several risks and challenges are associated with cloud but its potential benefits outweigh the risks. This paper begins with defining cloud computing, its key characteristics, deployment, service models, benefits and challenges. Then paper describes how cloud computing being used in education, with explaining the benefits, limitations and challenges of using it in education field.

Keywords: Cloud computing, Characteristics of Cloud computing, Models of Cloud computing, Cloud Computing Providers, Benefits, Limitations, Challenges of Cloud Computing, Cloud Computing in Education.

1-Introdution

Cloud computing is a model for enabling 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 . Cloud computing has emerged as a popular solution to provide cheap and easy access to externalized IT (Information Technology) resources. An increasing number of organizations (e.g., research centers, enterprises) benefit from Cloud computing to host their applications. Through virtualization, Cloud computing is able to address with the same physical infrastructure a large client base with different computational needs . In contrast to previous paradigms (Clusters and Grid computing), Cloud computing is not application-oriented but service-oriented; it offers on demand virtualized resources as measurable and billable utilities[1] . Figure[1] shows a basic cloud computing environment.

2-Cloud characteristics

Cloud computing has a variety of characteristics, with the main ones being:

*** Shared Infrastructure** — Uses a virtualized software model, enabling the sharing of physical services, storage, and networking capabilities. The cloud infrastructure, regardless of deployment model, seeks to make the most of the available infrastructure across a number of users.

*** Dynamic Provisioning** — Allows for the provision of services based on current demand requirements. This is done automatically using software automation, enabling the expansion and contraction of service capability, as needed. This dynamic scaling needs to be done while maintaining high levels of reliability and security.

*** Network Access** — Needs to be accessed across the internet from a broad range of devices such as PCs, laptops, and mobile devices, using standards-based APIs (for example, ones based on HTTP). Deployments of services in the cloud include everything from using business applications to the latest application on the newest smartphones.

*** Managed Metering** — Uses metering for managing and optimizing the service and to provide reporting and billing information. In this way, consumers are billed for services according to how much they have actually used during the billing period.

In short, cloud computing allows for the sharing and scalable deployment of services, as needed, from almost any location, and for which the customer can be billed based on actual usage[1,2].

Figure[1] Cloud Computing Environment

3-Deployment Model

The deployment models defined by the cloud community are Public Cloud, Private Cloud, Hybrid Cloud and Community Cloud.

- **Public Cloud:** One of the leading forms of the current computing deployment model. Mainly used by the general public cloud consumer and the policy, value and costing are defined by the service provider. The popular public cloud services are Amazon EC2, S3, Google App Engine, and Force.com.

- **Private Cloud:** This is a cloud model for a single organization and managed by organization or a third party. The infrastructure can be located on premise or off premise. Primary reason for implementing private cloud is to maximize and utilize existing in-house resources. Secondary reasons include the data privacy and trust for security. Finally, data transfer cost and to have full control over mission-critical activities behind the firewalls. Academic institutions build private cloud for research and teaching purpose.

- **Hybrid Cloud:** It is a combination of two or more clouds viz., private, community or public. In order to optimize the resource and to utilize core competency of the public cloud organizations use the hybrid cloud. Virtual Private Cloud (VPC) is a deployment model of Amazon Web Services (AWS). Using VPC it is possible to have a secure and seamless bridge between IT infrastructure of an organization and Amazon public cloud. Hybrid cloud is the combination of public and private cloud.

- **Community Cloud:** Several organization of same group shares their cloud resources and jointly constructs the policies and requirements. The infrastructure of the cloud can be hosted by a third-party vendor or within one of the organizations in the community[2,3].

4-Cloud Computing Service Models

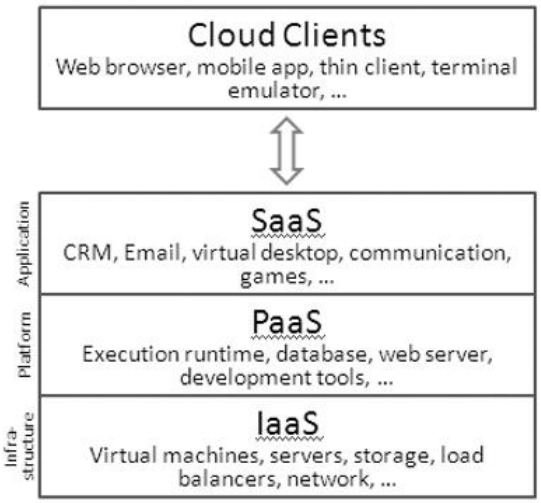
Cloud service models describe how cloud services are made available to clients. Most fundamental service models include a combination of IaaS (infrastructure as a service), PaaS (platform as a service), and SaaS (software as a service). These service models may have synergies between each other and be interdependent – for example, PaaS is dependent on IaaS because application platforms require physical infrastructure.

The IaaS (Infrastructure as a Service) model provides infrastructure components to clients. Components may include virtual machines, storage, networks, firewalls, load balancers, and so on. With IaaS, clients have direct access to the lowest-level software in the stack – that is, to the operating system on virtual machines, or to the management dashboard of a firewall or load balancer. Amazon Web Services is one of largest IaaS providers.

The PaaS (Platform as a Service) model delivers a pre-built application platform to the client; clients needn't spend time building underlying infrastructure for their applications. On the backend, PaaS automatically scales and provisions required infrastructure components depending on application requirements. Typically, PaaS solutions provide an API that includes a set of functions for programmatic platform management and solution development. Google AppEngine is a popular PaaS provider, and Amazon Web Services also provides some PaaS solutions in addition to IaaS offerings.

SaaS (Software as a Service) provides ready online software solutions. The SaaS software provider has complete control of application software. SaaS application examples include online mail, project-management systems, CRMs, and social media platforms.

The main difference between SaaS and PaaS is that PaaS normally represents a platform for application development, while SaaS provides online applications that are already developed[4]. See figure[2] which describes cloud computing service models.



Figure[2] Cloud Computing Service Models

5-Cloud Computing Benefits

Enterprises would need to align their applications, so as to exploit the architecture models that Cloud Computing offers. Some of the typical benefits are listed below:

- **Reduced Cost**

There are a number of reasons to attribute Cloud technology with lower costs. The billing model is pay as per usage; the infrastructure is not purchased thus lowering maintenance. Initial expense and recurring expenses are much lower than traditional computing.

- **Increased Storage**

With the massive Infrastructure that is offered by Cloud providers today, storage & maintenance of large volumes of data is a reality. Sudden workload spikes are also managed effectively & efficiently, since the cloud can scale dynamically.

- **Flexibility**

This is an extremely important characteristic. With enterprises having to adapt, even more rapidly, to changing business conditions, speed to deliver is critical. Cloud computing stresses on getting applications to market very quickly, by using the most appropriate building blocks necessary for deployment[4,5].

6-Cloud Computing Challenges

Despite its growing influence, concerns regarding cloud computing still remain. In our opinion, the benefits outweigh the drawbacks and the model is worth exploring. Some common challenges are:

- **Data Protection**

Data Security is a crucial element that warrants scrutiny. Enterprises are reluctant to buy an assurance of business data security from vendors. They fear losing data to competition and the data confidentiality of consumers. In many instances, the actual storage location is not disclosed, adding onto the security concerns of enterprises. In the existing models, firewalls across data centers (owned by enterprises) protect this sensitive information. In the cloud model, Service providers are responsible for maintaining data security and enterprises would have to rely on them.

- **Data Recovery and Availability**

All business applications have Service level agreements that are stringently followed. Operational teams play a key role in management of service level agreements and runtime governance of applications. In production environments, operational teams support Appropriate clustering and Fail over Data Replication System monitoring (Transactions monitoring, logs monitoring and others) Maintenance (Runtime Governance) Disaster recovery Capacity and performance management If, any of the above mentioned services is under-served by a cloud provider, the damage & impact could be severe.

- **Management Capabilities**

Despite there being multiple cloud providers, the management of platform and infrastructure is still in its infancy. Features like „Auto-scaling" for example, are a crucial requirement for many enterprises. There is huge potential to improve on the scalability and load balancing features provided today.

- **Regulatory and Compliance Restrictions**

In some of the European countries, Government regulations do not allow customer's personal information and other sensitive information to be physically located outside the state or country. In order to meet such requirements, cloud providers need to setup a data center or a storage site exclusively within the country to comply with regulations. Having such an infrastructure may not always be feasible and is a big challenge for cloud providers[3,4,5].

7-How is Cloud Computing Being Applied in Education?

Many educational institutes have begun their movement to cloud computing by outsourcing their student email provision. Email is a basic, fairly standardized service, can be provided easily by third parties, and is arguably not core to the educational mission. Both Google and Microsoft offer email services for free to the educational sector in many countries.

These two companies provide email as a part of larger application suites which are usually made available to students alongside email. Google Apps for Education and Microsoft Live@edu contain other communication tools such as instant messaging along with contact management and calendar so ware. There are also document creation applications allowing the production of word processed documents, spreadsheets and presentations as well as the ability to create websites. These can all be edited collaboratively with other users. Significant storage space for documents of all types are offered to users who can continue to use these once they leave the institution.

Why are the services provided for free to educational institutions? There are a number of advantages to companies who are currently competing for market share. So ware has always been provided at a discount to the educational sector and vendors seek to build relationships with the institutions which provide their future employees. In addition they are building brand awareness and loyalty which may lead to the selling of other or premium services to ins tu ons and users in the future. A student seeing the benefit of these tools may persuade a future employer to invest in the commercial equivalents which provide a more revenue source to the cloud providers.

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 hardware and so ware themselves[6].

8-Cloud Computing Providers

A. Microsoft Live@edu for education

Microsoft Live@edu is intended for educational needs. It provides a set of hosted collaboration services for the educations institutions. The hosted service includes collaboration services, communication tools, mobile, desktop, and web-based applications. It has the feature of data storage capabilities. Office Live Workspace, Windows Live SkyDrive, Windows Live Spaces, Microsoft Shared View Beta, Microsoft Outlook Live, Windows Live Messenger and Windows Live Alerts are the part of Live@edu suite. By means of free registration process universities, colleges and schools can enroll in the program [4]. Microsoft Live@edu is mainly for the institutions for enabling facilities for their academic activities.

B. Google Apps for Education

Google Apps is a collection of web-based programs and file storage that run in a web browser, without requiring users to buy or install software. Users can simply log in to the service to access their files and the tools to manipulate them. The communication tools of Google Apps are Gmail, Google Talk, and Google Calendar and the productivity tools are Google Docs: text files, spreadsheets, and presentations, iGoogle and Google Sites to develop web pages [5]. The tools are free, or users can pay for a Premium Edition that adds more storage space and other features. An Education Edition includes most of the extras in the Premium Edition and is offered at no cost to K–12 (designation for the sum of primary and secondary education and higher education). Google Apps allows institutions to use their own domain name with the service and to

customize the interface to reflect the branding of that institution. In this way, a college or university can offer the functionality of Google Apps in a package[6].

C. Amazon Web Services for Education (AWS)

Amazon Web Services provides the cloud services in categories of Compute, Software, Content Delivery, Database, Storage, Deployment & Management, Application Services and Workforce [6].

Compute service includes Amazon Elastic Computer Cloud (EC2), Amazon Elastic MapReduce, Auto Scaling and Elastic Load Balancing. Amazon Elastic Compute Cloud delivers scalable, pay-as-you-go compute capacity in the cloud. Amazon Elastic MapReduce is a web service that enables businesses, researchers, data analysts, and developers to easily and cost-effectively process vast amounts of data. Auto Scaling allows user to automatically scale your Amazon EC2 capacity up or down according to conditions. Elastic Load Balancing automatically distributes incoming application traffic across multiple Amazon EC2 instances.

In Software, AWS Marketplace is an online store that helps customers find, buy, and immediately start using software that runs on the AWS cloud. It includes software from trusted vendors like SAP, Zend, Microsoft, IBM, Canonical, and 10gen as well as many widely used open source offerings including Wordpress, Drupal, and MediaWiki.

In Content Delivery, Amazon CloudFront is a web service that makes it easy to distribute content with low latency via a global network of edge locations.

In Database, it has the category of Amazon Relational Database Service (RDS), Amazon DynamoDB, Amazon SimpleDB and Amazon Elastic Cache.

Amazon Relational Database Service is a web service that makes it easy to set up, operate, and scale a relational database in the cloud. Amazon DynamoDB is a fully-managed, high performance, NoSQL database service that is easy to set up, operate, and scale. Amazon SimpleDB is a managed NoSQL database service designed for smaller datasets. Amazon ElastiCache is a web service that makes it easy to deploy, operate, and scale an in-memory cache in the cloud.

In Networking, the classifications are Amazon Route S3, Amazon Virtual Private Cloud (VPC) and AWS Direct Connect.

In Storage, depending on the needs the service provided by AWS are Amazon Simple Storage Service(S3), Amazon Glacier, Amazon Elastic Block Store (EBS), AWS Import/Export and AWS Storage Gateway.

Application Services of AWS are Amazon CloudSearch, Amazon Simple Workflow Service (SWF), Amazon Simple Queue Service (SQS), Amazon Simple Notification Service (SNS) and Amazon Simple Email Service (SES).

In Workforce, Amazon Mechanical Turk enables companies to access thousands of global workers on demand and programmatically integrate their work into various business processes.

As for as education, educators, academic researchers, and students can apply to obtain free usage credits and can utilize on-demand infrastructure. With the grants, educational institutions have made advances in research, enable High-Performance Computing and tackled Big Data. AWS is providing educators up to $100USD as grants as free usage for each student enrolled in courses.

Researchers around the world have access to global computing infrastructure and storage capacity of the AWS cloud. Instead of purchasing a large amount of hardware, researchers can get started by simply opening an AWS account. With services like Amazon Elastic MapReduce much of the heavy lifting of provisioning and configuring Hadoop clusters for data-intensive processing is eliminated. The feature is available for the researchers with grants.

AWS in Education is supporting student organizations around the world and compelling entrepreneurial student initiatives including Project Olympus at Carnegie Mellon, Teams in Engineering Service at the University of California, San Diego, and the "3 Day Start Up" event at the University of Texas, Austin. AWS provides Project Grants supporting free usage of AWS to student organizations and student entrepreneurial projects. AWS in Education is working with many Independent Software Vendors (ISV) and System Integrators (SI) to bring solutions for common education infrastructure challenges like storage, disaster recovery, archiving and content delivery[3,6,7]

9-Benefits and limitations of using cloud computing in education

Educational institutions are among many organizations that find cloud computing systems useful for simplifying admission and administration processes, as well as improving general staff communication. By outsourcing infrastructure, platform or software as a service, educational institutions can benefit in terms of both cost reduction and efficiency.

As reported by most of the organizations currently using the cloud, the primary benefit of this platform is its cost-efficiency. The cloud represents an ideal place for large organizations to store, process and analyze data because it requires minimum hardware investments. Besides this, by implementing cloud-based software tools, such institutions get constant access to different collaborative environments and mission critical applications.

There are nine major benefits and limitations of using cloud computing in education. The summary of their conclusions is given in table[1] below[7,8,9].

Table 2 shows overview of some of the challenges higher education will face in adopting cloud computing [10,11].

Benefits	Limitations
Access to applications from anywhere	Not all applications run in cloud
Support for teaching and learning	Risks related to data protection and security and accounts management
Software free or pay per use	Organizational support
24 hours access to infrastructure and content	Dissemination politics, intellectual property
Opening to business environment and advanced research	Security and protection of sensitive data
Protection of the environment by using green technologies	Maturity of solutions
Increased openness of students to new technologies	Lack of confidence
Increasing functional capabilities	Standards adherence
Offline usage with further synchronization opportunities	Speed/lack of Internet can affect work methods

Table[1] Benefits and Limitations of Using Cloud Computing in Education

10-Challenges of Cloud Computing in Education

Many challenges of cloud computing for higher education relate to its relative newness and the underdevelopment of the marketplace for cloud services. For higher education, decisions to adopt cloud computing will be influenced by more than technical and cost considerations.

Information is the lifeblood of higher education, and decisions on how to manage that information can have far-reaching political, social, and economic considerations. Adoption of cloud computing presents many of the same risks and challenges as deciding to use a more traditional outsourcing arrangement. The increased possibility that the service provider or its resources may reside outside of a government's legal or territorial jurisdiction, however, can make some of these concerns more acute.

Security	The key concern is data privacy: users do not have control or know where their data is being stored.
Interoperability	A universal set of standards and/or interfaces have not yet been defined, resulting in a significant risk of vendor lock-in.
Control	The amount of control that the user has over the cloud environment varies greatly.
Performance	All access to the cloud is done via the internet, introducing latency into every communication between the user and the environment.
Reliability	Many existing cloud infrastructures leverage commodity hardware that is known to fail unexpectedly.

Table[2] some of the challenges higher education will face in adopting cloud computing

Conclusion

Cloud computing has been growing rapidly; it evolves models offering significant advantages, yet potential fallacies as well. Cloud computing seems to be worth exploring from small businesses and major enterprises to elite universities and online colleges. The cloud is poised to revolutionize the educational sector, and schools and learning institutions. Basically, cloud computing will enable learners to formally undergo education even without going to the four-walled classrooms. In fact cloud can also help those families who travel a lot, cloud computing will allow their children to travel while continually learning lessons, submitting assignment, and getting grades. As a coin has two facets so as cloud computing therefore the decision taking of using Cloud Computing must also take into account the risks associated with it. But by using cloud the gain that exceeds the capital costs may compensates the associated risks. Some of the risks specific to cloud environment may be transferred to cloud providers. Cloud Computing having both strong and weak aspects , we may say that the scalable, portable, payment per use model and the management policies of risks and security , efficiency ,anytime accessibility and several other aspects represent positive factors in taking the decision of using Cloud

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References

1- J. SRINIVAS. , K.VENKATA SUBBA REDDY and Dr.A.MOIZ QYSER , ***"Cloud Computing Basics "*** , International Journal of Advanced Research in Computer and Communication Engineering,Vol. 1, Issue 5, July 2012.

2- BV Pranay kumar , Sumitha kommareddy , N.Uma Rani , ***"EFFECTIVE WAYS CLOUD COMPUTING CAN CONTRIBUTE TO EDUCATION SUCCESS",*** Advanced Computing: An International Journal (ACIJ), Vol.4, No.4, July 2013

3- Ramkumar Lakshminarayanan, Dr. Binod Kumar, M. Raju , ***"Cloud Computing Benefits for Educational Institutions"***, Higher College of Technology, Muscat, Oman.

4- Eugene Gorelik , ***"Cloud Computing Models'*** , M.Sc. Thesis , MIT Sloan School of Management and the MIT Engineering Systems Division , January 2013.

5- Mohmed Sirelkhtem Adrees, Majzoob Kamal Aldein Omer, Osama E. Sheta , ***"CLOUD COMPUTING ARCHITECTURE FOR HIGHER EDUCATION IN THE THIRD WORLD COUNTRIES (REPUBLIC OF THE SUDAN AS MODEL"*** , International Journal of Database Management Systems (IJDMS) Vol.7, No.3, June 2015.

6- Thomas Erl, Zaigham Mahmood, Ricardo Puttini***," Cloud Computing : Concepts, Technology & Architecture"*** , ServiceTech Press , September 2013.

7- D. CHAPPELL, ***"A SHORT INTRODUCTION TO CLOUD PLATFORMS"***, CHAPPELL & ASSOCIATES, August 2008.

8- Saju Mathew , ***"Implementation of Cloud Computing in Education - A Revolution"*** , International Journal of Computer Theory and Engineering, Vol. 4, No. 3, June 2012

9- Anjali Jain, U.S Pandey , ***"Role of Cloud Computing in Higher Education"***, International Journal of Advanced Research in Computer Science and Software Engineering , Volume 3, Issue 7, July 2013.

10- E. Krelja Kurelović , S. Rako, J. Tomljanović , ***"Cloud Computing in Education and Student's Needs"***, MIPRO 2013 .

11- Rania Mohammedameen Almajalid***," A Survey on the Adoption of Cloud Computing in Education Sector "***, College of Computing and Informatics, Saudi Electronic University, Jeddah, Saudi Arabia.