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Presented by :

Najey   . Shemas   163110441

Mustafa .   Elkhenfas   163110468

Osama .   Hamad   163110442

Presented to :

Prof.Dr.hasan balik

Cloud computing in education

"It's one of the foundations of the next generation of computing. . .. It's a world where the network is the platform for all computing, where everything we think of as a computer today is just a device that connects to the big computer we're building. Cloud computing is a great way to think about how we'll deliver computing services in the future."
—Tim O'Reilly, CEO, O'Reilly Media

Introduction:

A lot of organization using the computing resources to save their data, implement their applications and develop their programs; these computers need maintenance, management and place to save. Also the needs to these computers different from time to another, where sometimes there is a most needy for them and in other times the needs minimize.

For that the organizations start thinking for alternative solutions save the resources and work in effectively manner, one of these solution was the cloud computing which provide the users a lot of choices through the internet.

The foundation of cloud computing:

The cloud computing term used in the late sixties, the term has inspired from the cloud, as in the case with many other new technologies, it means different things to different people and it was the motivation for many suppliers to step up their own product range. [1]

The idea of cloud computing appeared in the sixties where John McCarthy expressed his opinion that "computation may someday be organized as a public utility". [2]

However, the cloud computing applications did not actually appear only at the beginning of 2000, when a Microsoft Corp. expand the concept of using software through the Web, after that many companies followed Microsoft, but one of the most companies that have played an important role in the field of cloud computing is Google, which has launched many services that depend on this technology, but Google not just launched services using the cloud computing, in 2009 they launched integrated computing system that works through the concept of cloud computing.

The concept of the cloud:

Model is to provide appropriate access and permanently at any time and from any device to the network to share a wide range of computing resources that can be deployed and provided the minimal effort or interaction between service providers. [3]

The concept of cloud computing:

Its transferring the treatment process from the user's PC to the servers through the internet and saving the users files there to be accessed from anywhere and any device; in this way the programs being just services and the user computer being an interface of a digital window, and the server using virtual techniques to enable many users to use the same service". [4]

The cloud computing can be defined as " its a techniqe relies on the transfer the processing and the storage from the user computer to the to what is called the cloud, which is accessed via the Internet." [5]

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. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models. [6]

Cloud computing characteristics: [7]

Zaigham Mahmood descript the essential characteristics of Cloud Computing as following:

• On-demand self-service that enables users to consume computing capabilities (e.g. applications, server time, network storage) as and when required.

• Resource pooling that allows combining computing resources (e.g. hardware, software, processing, network bandwidth) to serve multiple consumers, such resources being dynamically assigned.

 • Rapid elasticity and scalability that allows functionalities and resources to be rapidly and automatically provisioned and scaled.

• Measured provision to optimize resource allocation and to provide a metering capability to determine usage for billing purposes Extension to existing hardware and application resources, thus, reducing the cost of additional resource provisioning.

The cloud computing models architectures: [7]

The Cloud model generally consists of three varieties of architectures:

1. Infrastructure Model: Infrastructure as a Service IaaS:

Zaigham Mahmood defined it as "This layer is essentially hardware (e.g. visualized servers, storage, network devices, etc) and hardware services to enable Cloud Platforms and Applications to operate. These services support the 'software services' top layer of the pyramid. Customers get full control over server infrastructure and that sometimes comes with a price premium".

Amazon EC2, IBM BlueHouse, VMWare, GoGrid, RightScale and Linode are some of the IaaS products and providers.

For example:

A company x want to apply a new E-mail system to match their employees in all branches and across many countries, rather than buying the system and assisting the services in the all offices which cost a lot of money, they simply can communicate with Microsoft (service provider) for example to host the email on their servers . And thus instead of communication between staff on the local network, and install a mail program on their computers. Now can access the cloud and use e-mail easily.

2. Platform as a Service: PaaS

Zaigham Mahmood defined it as "This layer refers to software and product development tools (e.g. application servers, database servers, portal servers, middleware, etc) which clients purchase so they can build and deploy their own applications, thus providing a much increased flexibility and control to the consumer. However, there may sometimes be a certain amount of dependence upon the infrastructures

and platform providers. The services, here, are intended to support the 'software services' top layer of the pyramid. The customers are looking to buy time and cost savings in deploying their applications. Typical offerings include runtime environment for application code, Cloud Services, Compute power, storage, and networking infrastructure. This level of services may be regarded as a developer level layer. The pricing structure is often along the lines of: Compute usage per hour; data transfer per GB; IO requests per million; storage per GB; data storage requests per thousand. All charges are per each billing period. Google App Engine, Heroku, Mosso and Engine Yard are examples of PaaS products and providers".

For example:

Google Apps which is a platform enables the users to add applications as desired

3. Software as a Service: SaaS

Zaigham Mahmood defined it as "This refers to prebuilt and vertically integrated applications (e.g. an email system, human resource management, payroll processing, database processing and other application processes) are delivered to and purchased by customers as services. Here, customers are looking to purchase functionality. Applications are normally designed for ease of use based on proven business models. This may be regarded as a user level layer and it can be further classified into two separate layers: 1) Services (which are often standalone applications e.g. a billing service); and 2) Applications (which are often units of functionalities). SaaS is a very broad market where services can be anything from Web-based email to inventory control, even in some cases online banking services, as well as database processing. Gmail, Hotmail, Quicken Online, IBM® WebSphere, Boomi and SalesForce are some of the well-known SaaS products and providers".

For example:

Photoshop program is exist in a data center and enable the user to alter the images and get the output, all of that done in the cloud and your computer is just a communication tool. Here the user can't control the cloud system or the cloud hardware. We can consider YouTube in this category, where the video explorer is like an application in the cloud, and through it you can access the videos but you can change anything in the website

Cloud computing Deployment Models:

The cloud computing using different ways according to the organization, where each organization has its special requirements about what the services which the organization want to access through the cloud, and what the control level want on the cloud

For that the National Institute of Standards and Technology (NIST) defined four Cloud computing Deployment Models as following: [6]

"Private cloud: The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise".

"Community cloud: The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premise or off premise".

"Public cloud: The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services".

"Hybrid cloud: The cloud infrastructure is a composition of two or more clouds (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 computing services Pricing Mechanisms:

The different services which presented by the cloud computing providers, required a new mechanisms for pricing, these mechanisms based on multiple, measured tiers such as response time, availability, throughput etc. Inderveer Chana1 and Tarandeep Kaur defined the following pricing types: [8]

1. Flat Rate Model: "A flat fee, also referred to as a flat rate or a linear rate, refers to a pricing structure that charges a single fixed fee for a service, regardless of usage. For Internet service providers, flat rate is access to the Internet at all hours and days of the year (linear rate) at a fixed and cheap tariff".

2. Tiered Model: "Service providers are increasingly selling "tiered" contracts, which offer utility services to wholesale customers in bundles, at rates based on the cost of the links that the traffic in the bundle is traversing. An approach is by increasing block rates (hereafter, IBR or tiered pricing), where individuals pay a low rate for an initial consumption block and a higher rate as they increase use beyond that block".

3. Subscription Model: "The subscription model is a business model in which the customers pay a subscription price to have access to the products/services. Industries that use this model include cable television, satellite television providers, telephone companies, cell phone companies, internet providers, software providers".

4. Metered Services: "Metered services involve measuring the amount of consumption of the resources used by the users and then billing them on the basis of the meter reading. This model prevents users from paying extra as in case of fixed price model".

5. Pay as you go Model: "It involves charging customers based on their usage and consumption of a service. IBM offers services based on pay-as-you-go model. It is also called as "Pricing based on consumption"".

6. Standing Charges Scheme: "Tariffs with a standing charge involve payments at flat rate charges for the supply as well as for the amount of power usage".

Top cloud computing services providers: [8]

Inderveer Chana1 and Tarandeep Kaur classified the following 7 top cloud computing services providers in the market who provide different utility services such as storage facility, web hosting facility etc.

Service Providers	Offerings	Solutions	Clients
IBM Smart Cloud	- High-performance - Scalability - Security-rich - Simplified restore capabilities - Web-based security services	- Smart Business Storage Cloud. - IBM SmartCloud Archive - IBM SmartCloud managed backup services - IBM SmartCloud Virtualized Server Recovery - IBM Managed Security Services Management	- SAP - Oracle - Lotus - PeopleSoft
Google	- Scalability - Cost saving - High Speed	- Google App Engine - Google Cloud Storage	- Gigya - Mimiboard - Hudora - Ubisoft - PocketGems
FlexiScale	- Flexibility - Scalability - High QoS - Reliability - Compatibility - Fully virtualized storage.	- Flexiant Cloud Orchestrator - Reseller Hosting: White Label FlexiScale - FlexiScale 2.0: Flexible & Scalable Public Cloud Hosting	- Logica - Yahoo - Oracle - Telecom Italia - ERISS
HP Converged Cloud	- Flexibility - Simplicity - Scalability - High Speed - Reduced cost and risks - Efficiency - Enhanced disaster recovery	- Enterprise Cloud Services - Cloud Consulting Services - Cloud Education Services - Cloud Education Services - Data Center Services	- CloudAgile - Avaya - Citrix - ExpertOne - PartnerOne
Amazon EC2 (Elastic Compute Cloud)	- Scalability - Pay-as-you Go - Flexibility - Reliability - Secure - Inexpensive - Elasticity	- Amazon Elastic Block Store - Amazon Virtual Private Cloud - Amazon CloudWatch	- Zoomii - Morph - Washington Post - Many Facebook applications
Amazon S3	- Highly scalable - Data Durability and Reliability - Pay-as-you Go - Security - Fast - Inexpensive	- Amazon Glacier - Amazon CloudFront - Amazon EBS	- DragonDisk - Posterous - Tumblr - Formspring

Cloud computing applications:

In the following we will introduce some cloud computing applications and their uses: [9]

Using	Application name
Google Docs contains many office applications in one group, completely free, its working inside Gmail platform and its available for all the Gmail users, it enables the users to work on their documents online without need to download it, and it provides the following services: Writing documents, make presentations, make calculations, charts, tables and questionnaires All this simultaneously with the Google account and the availability of different powers for each document and share it with others.	Google Docs
It's an application enables the users to create videos online, its doesn't require special specifications to works, it's just needs a browser and Flash Player, it contains many functions to edit and produce movies, like recording from the web camera and export the movies to YouTube; its available in many languages	Jay cut
Its application enables the users to produce music clips from the beginning until the end; through it you can edit music clips, add other musical instruments, and other professional advantages in the music worlds. It's a real successful model for programs Media multiple and running on the cloud.	Aviary Music Creator
Coloud enables the users to create your own space on the internet to store whatever you want from files, which enables users to store and access files from anywhere	Drop box

There are a lot of cloud computing applications examples. We can enrich our previous examples with the following cloud computing classes' examples:

The Mail services: Gmail, Yahoo, Hotmail

The storage services: One Drive Google Drive, Drop box

The music services: Google music, Amazon cloud player, iTunes/ I Cloud

The cloud applications: Google docs, Photoshop express

The cloud operating systems: Google chrome OS, Jolie cloud

The advantage of using the cloud computing in education: [10]

Recently have been recognition the importance and efficiency of employing cloud computing in educational, research and administrative activities of educational institutions, especially the higher education institutes.

The main benefits of it are:

- Enables the user to access files and applications through the cloud without the need to provide the application in the user device which in turn less security risks and the resources required hardware.

- Save a lot of money to purchase software needed by the user, where all the user needs is a computer connected to fast Internet line and be connected to one of the sites that offer software it needs.

- Reduce the operational cost, through reducing the number of infrastructure servers which in turn reduce the number of employees in the maintenance of the hardware and software in the enterprise.

- The architectural environment of cloud computing include available data centers that are able to provide the service to customers based on the level of the world as a whole.

- The learning institutes don't have the enough resources and infrastructures which enable the E-learning implementation and buying the modern release, so the use of cloud computing technology helps these institutions to use modern versions of hardware and software.

- The e-learning services using for a specified period of time (weeks, quarterly - a semester), the cost saving is very important

Also there are advantages for using cloud computing in learning related with the students like:

• Conduct tests directly.

• Easy to send exercises and projects for students.

• Easy access to the tests and exercises and projects submitted by students.

• Easy exchange feedback between students and teachers.

• Ease of communication between students and teachers.

• Ease of communication between students.

• Helping to teach students new ways to develop the abilities of their projects and duties administration.

• Help students and teachers to use applications without loaded on their computers and help them to access stored files from any computer with an Internet connection.

• Students can access all programs at any time and from anywhere.

• access to systems to develop applications and stored in the infrastructure of the institution.

• The possibility of developing customized training courses per semester.

And according to a report done by a Intel education, they noticed increasing use for the using of Google Apps in education where "Google Apps for Education has skyrocketed in adoptions, growing; its user base of administrators, teachers and students from 10 million in 201031, to 20 million in 201232 to more than 40 million worldwide in 2014". [11]

And there are other benefits can the cloud computing offers to the E-learning for example:

1. Encourage cooperation and communication:

The cloud computing Encourage the collaboration between learners and teachers and others in academia. Because it is easy to access files by different users to make changes on document such as management plans or school projects. It would be very easy for the teacher to propose amendments to an article or a duty presented by the student, the teacher can access the student file in cloud, make his comments and

notify the student about the changes through the system; no more papers or multiple correspondence by e-mail, everything is integrated into one system for easy access.

2. Reducing the learning material cost:

Because the cloud provides a lot of resources and shared services, it will enable teachers and students to reduce spending on different materials as a professor can be performed to download lectures to the cloud, thus eliminating the need for books and lectures, paper and reduce printing and reproduction costs. All it takes is a student then a computer can have access to the different subjects on the cloud.

3. Provides comfortable experience:

Cloud Computing offers students and teachers both more convenient and efficient learning experience. The cloud keeps everything in one place: Grade records, attendance, homework, curricula and teaching others. Everyone can access to the system and access to the different materials and the process of greater benefit to students who are studying via the Internet and those who need flexibility in order to succeed in completing the educational program.

4. Simplify the registration process and acceptance in universities, which are operations that are expensive and time-consuming

5. Storing extensive amounts of sensitive data and information that can be accessed easily.

Cloud offering for educational institutions various resources and opportunities for the development of efficient applications, easy to use and effective for students. Maybe in the future the cloud computing will have a significant impact on the educational environment, as it can infrastructure and resources necessary for learners offer to perform any number of tasks on the cloud while minimizing cost and offering them easy access a huge amount of information that is available on the internet. As a whole, the cloud computing industry continues to see healthy expansion as strong data reflects an increase in sales, adoption and business acceptance. Furthermore, according to Gartner, by 2020, a corporate "no-cloud" policy will be as rare as a "noInternet" policy is today. [12]

According to the Surveys conducted by the magazine survey Ed Tech Magazine indicate that: [10]

• 28% of colleges applying cloud computing.

• 29% of the colleges are planning to adopt cloud.

• 32% of the colleges in the discovery phase of cloud computing.

The surveys indicate that by 2020 the higher education institutes will focus strongly on technology and methodologies which use the cloud technology solutions, such as: [10]

o conferencing

o distance learning

o hybrid classes Hybrid classes (online learning and off-campus)

The challenges of using the cloud computing in education:

the cloud computing enables many opportunities, and highlights the many advantages through working, but on the other side many challenges stand to the users; Cloud computing may not provide all the services needed by the beneficiary, or the cloud service which available does not meet the needs of the

beneficiary; in following we highlight on some challenges may facing the organizations through implementing the cloud computing technologies:

1. security threats: which is one of the main threats facing cloud computing implementation, the most important security threats are: the loss of privacy, and tampering and leakage of sensitive data; therefore there must be a number of security requirements in the cloud systems to protect the data from such risks, which include this the following:

- Identification of identity and reliability: the users' accounts must be done by the cloud service provider

- The license: the resources must be protected, therefore must have certain privileges for each user based on their accounts

- Integrity and Confidentiality: encryption techniques must be used to protect organization sensitive data.

2. Data loss: As long as the files are placed in the data center of the cloud, it means that the data are all centered in one area of the network, Technical failure may get happen, which lead to the suspension of the service provider that means all work will cease pending until the failure fixing.

3. Cloud computing is linked to connect to the Internet: If there is no Internet connection, it means not being able to access files and applications; and therefore the slow speed of the Internet has weak the work on the cloud.

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