APPLIANCE OF CLOUD COMPUTING ON E-LEARNING

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Abstract - The looking education on the internet, the wonderful web-based education environment has become one of the warm points on researching remote education. Cloud computing is rising rapidly, with applications in almost all area, including education. Cloud computing builds on decades of research in virtualization, distributed computing, utility computing, and more recently networking, web and software services. E-learning systems usually require many hardware and software resources. Cloud computing technologies although in their early stages, have managed to change the way applications are going to be developed and accessed. The biggest players in the field of e-learning software have now versions of the base applications that are cloud oriented. However, the current models of e-learning ecosystems lack the support of underlying infrastructures, which can dynamically allocate the required computation and storage resources for e-learning ecosystems. These technologies are aimed at running applications as services over the internet on a flexible infrastructure. Cloud computing provides a low cost solution to educational institutions for faculty, for their researchers and students. This paper presents the impact of using cloud computing architectures upon e-learning solutions development. We combined various technologies to achieve this objective. We introduces the characteristics of the current E-Learning and then analyses the concept of cloud computing and describes the architecture of cloud computing platform by combining the features of E-Learning. We presents the impact on using cloud computing for e-learning solutions.

II. CLOUD COMPUTING CONCEPT

Cloud computing embraces cyber infrastructure, and builds upon decades of research in networking, distributed computing, net computing, effectiveness computing, and web and software services. It reduced information technology overhead for the end-user, greater flexibility, reduced total cost of ownership, on demand services[2]. The cloud computing term was derived from the way the Internet is often represented in network diagrams. Due to the fact it involves the being of data centers that are able to provide services, for all the requests coming from the world wide spread clients, the cloud can be seen as an exclusive access point (see figure 1)[8].

Keywords-Cloud computing, Distributed computing, grid computing, Scalability, utility computing.

I. INTRODUCTION

“Cloud computing” is the next accepted action in the evolution of on-demand information technology services and products. It has been one of the most flourishing technology among the professional of IT and also the Business due to its flexibility in the space occupation and also the better support for the software and the Infrastructure it attracts more technology specialist towards it. Cloud computing allows to move the processing effort from the local devices to the data center facilities. The s/w is seen as a service and the applications and data are stored on multiple servers that can be accessed from the Internet. However, in traditional web-based e-learning mode, system construction and maintenance are located in interior of educational institutions or enterprises, which results in a lot of problems existed. cloud computing has many advantages such as expected performance, reduced upfront investment (i.e., software, hardware, and professional staff to maintain servers and upgrade software), high availability, reduced launching time, infinite scalability, tremendous fault-tolerance capability, and accessibility, enhanced collaboration, and mobility, allow users to use any device, such as a mobile phone, personal computer (PC) etc. Cloud computing is becoming an attractive technology due to its dynamic scalability and effective usage of the resources; it can be utilized under circumstances where the availability of resources is limited. This paper presents the impact of using cloud computing architectures upon e-learning solutions development. We combined various technologies to achieve this objective. We introduces the characteristics of the current E-Learning and then analyses the concept of cloud computing and describes the architecture of cloud computing platform by combining the features of E-Learning. We presents the impact on using cloud computing for e-learning solutions.

III. IMPACT OF CLOUD COMPUTING ON E-LEARNING

Cloud computing has several advantages, including cost-effectiveness, scalability, and availability. It allows organizations to scale up or down as needed, and it can provide access to data and applications from anywhere at any time. However, it also has some disadvantages, such as dependence on internet connectivity and potential security risks.

IV. CONCLUSION

In conclusion, cloud computing offers a promising future for e-learning solutions. It can provide flexibility, scalability, and accessibility to a wide range of users. However, it is important to consider the potential drawbacks of cloud computing, such as dependence on internet connectivity and security risks.

V. FUTURE WORK

Future work could focus on exploring the potential of cloud computing in e-learning solutions further. This could include developing new cloud-based e-learning platforms and evaluating their performance and user satisfaction.

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In recent years, cloud computing as a new kind of advanced technology accelerates the innovation for the computer industry. Cloud computing is a computing model based on networks, especially based on the Internet, whose task is to ensure that users can simply use the computing resources on demand and pay money according to their usage by a metering pattern similar to water and electricity consumption. Therefore, it brings a new business model, where the services it provides are becoming computing resources [12]. Users do not require any special knowledge about the concept of Cloud computing to connect their computers to the server where applications have been installed and use them. Users can communicate through Internet with remote servers. These servers can exchange their computing slots themselves [13].

III. ADVANTAGES IN CLOUD COMPUTING

The aim of a grid computing architecture is to solve large tasks by using the advantage of parallelism and concurrency, while the cloud computing is paying attention on relationship. Cloud computing becomes very popular because it moves the processing efforts from the local devices in the network to the data center facilities. Therefore, any device, could be able to solve difficult equations by simply passing the arguments to a service running at the data center level that will be able to give back the results in a very small moment. In these conditions, the security of data and applications becomes a very major issue. Cloud computing is widely accepted today due to its key advantages:

- The cost is low or even free in some cases. One can choose a subscription or in some cases, pay-as-you go plan - whichever works best with that organization business model.
- By using internet connected device with minimum s/w requirements, user can reach the same result because of strong connection exists between the user and their personal computer.
- Flexibility - Infrastructure can be scaled to maximize investments. Cloud computing allows dynamic scalability as demands fluctuate.
- Accessibility - This help makes data and services publicly available without make vulnerable sensitive information.
- when speaking about data security, the service quality is crucial and the need of the backups is critical.
- For some applications, can be used even in the offline mode, so when the client goes back online a synchronization process is refreshing the data;
- In order to work with the cloud, only the Internet connection is required;
- there is no need to download or install a specific software.
- If the client computer crashes, there are almost no data lost because everything is stored into the cloud.

Cloud Computing applications are mainly intended to help companies and individuals to stretch resources and work smarter by moving everything to the cloud. One of the biggest promoters of the cloud computing is Google that already owns a massive computer infrastructure (the cloud) where millions of people are connecting to. Today, the Google cloud can be accessed by Google Apps [6] intended to be software as a service suite dedicated to information sharing and security. Google Apps covers the following three main areas[8]:

- messaging (Gmail, Calendar and Google Talk),
- collaboration (Google Docs, Video and Sites) and
- security (email security, encryption and archiving).

IV. SERVICES IN CLOUD COMPUTING

Infrastructure as a Service. One can get on-demand computing and storage to host, scale, and manage applications and services. Using Microsoft data centers. In the previous generation of the information technology the data sharing which led the path for the knowledge sharing was not used by the users globally, in this generation the various streams have the knowledge of e-Learning and the Mobile based learning. In this present context the usage of the central data centre is a easy process for the education system however the cost of implementation and the maintenance of the data storage space and also the load capability also software licensing depends on the real time usage of these systems. Business streams can make revenue out of those expenses whereas for educational institutions which really want to motivate the learners and want to offer a quality education at affordable cost can achieve this by spending a large amount. This can be overcome by the present cloud computing technology that is "Pay as Use" (PAU).

Cloud computing comprises of three layers [5]:

A. IaaS

Infrastructure layer corresponds to IaaS infrastructure services, is the lowest layer of the network. Users can household to provide standard services, including computing power and storage resources. It turn the memory, storage and computing power into a virtual whole resource pool for the entire industry to provide the required of computing power and storage resources[5][6].

B. PaaS

Platform layer correspond to PaaS(Platform as a service) that made a higher level of abstraction on the base of IaaS layer.to Provides a development environment, test environment, server platforms and other services, users can develop applications based on Internet and other servers service providers infrastructure, then share it to other users[7].

C. SaaS

SaaS(Software as a service) is a software distribution model, designed for web delivery, user can deploy and access through the Internet hosting. SaaS providers need to build information for all network infrastructure, software, hardware, operating platform, and is responsible for the implementation of all post-maintenance and other services.

The customers can choose one or more services provided. Hardware devices like PCs, notebooks, mobile phones, PDAs or other devices or software applications like web browsers can be used as a cloud client[7].

V. E-LEARNING BASED CLOUD COMPUTING
The e-learning cannot completely replace teachers; it is only an updating for technology, concepts and tools, giving new content, concepts and methods for education, so the roles of teachers cannot be replaced. The teachers will still play leading roles and participate in developing and making use of e-learning cloud[4].

Internet has had a profound impact on the way we interact and work. It started as a medium to exchange information between computers. With increasing network speeds and wider penetration of Internet, software providers started moving their applications to the Web, and started offering their software’s as a service (SaaS). Organizations or individuals could now use enterprise level software’s for a small fee without having to install them on local infrastructure, and without worrying about how to maintain these applications. But all this while there was almost no innovation on how hardware infrastructure was deployed or licensed. One either had to create an in-house data center to deploy and manage their software systems, or had to take servers on rent in a data-center managed by someone. The blended learning strategy should improve the educational act. Moreover, the interactive content and virtual collaboration guarantee a high retention factor.

VI. BENEFITS OF CLOUD COMPUTING FOR E-LEARNING SOLUTIONS

E-learning is widely used today on different educational levels: continuous education, company trainings, academic courses, etc. There are various e-learning solutions from open source to commercial. There are at least two entities involved in an e-learning system: the students and the trainers[3]. E-learning systems can use benefit from cloud computing using:

- Infrastructure: use an e-learning solution on the provider’s infrastructure
- Platform: use and develop an e-learning solution based on the provider’s development interface
- Services: use the e-learning solution given by the provider.

A very big concern is related to the data security because both the software and the data are located on remote servers that can crash or disappear without any additional warnings. Even if it seems not very reasonable, the cloud computing provides some major security benefits for individuals and companies that are using/developing e-learning solutions, like the following:

A. Improved Improbability

It is almost impossible for any interested person (thief) to determine where is located the machine that stores some wanted data (tests, exam questions, results) or to find out which is the physical component he needs to steal in order to get a digital asset.

B. Virtualization

Makes possible the rapid replacement of a compromised cloud located server without major costs or damages[8]. It is very easy to create a clone of a virtual machine so the cloud downtime is expected to be reduced substantially;

C. Centralized Data Storage

Losing a cloud client is no longer a major incident while the main part of the applications and data is stored into the cloud so a new client can be connected very fast. Imagine what is happening today if a laptop that stores the examination questions is stolen[3].

There are various e-learning solutions from open source to business. There are at least two entities involved in an e-learning system: the students and the trainers.

The students:
- Take online course
- Take exams
- Send feedback
- Send homework, projects

The trainers:
- Deal with content management
- Prepare tests
- Assess tests, homework, projects taken by students
- Send feedback
- Communicate with students (forums)

Typically, e-learning systems are developed as spread applications, but this is not necessary so. The design of a spread e-learning system includes software components, like the client application, an application server and a database server (see figure) and the necessary hardware components (client computer, communication infrastructure and servers).

VII. CLOUD BASED E-LEARNING ARCHITECTURE

The e-learning cloud architecture can be divided into:

A. Infrastructure resources Layer
The base layer of e-learning cloud shares IT infrastructure resources and connects the huge system pool together to provide services. Cloud Computing allows the hardware layer to run more like the internet, to make the hardware resources shared and accessed as data resources in secure and scalable way[4]. Information infrastructure contains Internet/Intranet, system software, information management system and some s/w and h/w; teaching resources is accumulated in traditional teaching model and distributed in different departments and domain. Through the use of virtualization technology, physical server, storage and network form virtualization group for being called by upper software platform.

Virtualization technology separates the physical hardware from operating system, which on one hand can make computing and storage capacity of the existing server into smaller size and re-integration, to improve the utilization and flexibility of IT resource; on the other hand can provide a common interface for large-scale cloud computing integration that enables the publication of calculation. The physical host pool is dynamic and scalable[7].

B. Software resource layer

Is composed by operating system and middleware. Through middleware technology, a variety of software resources are integrated to provide a combined interface for software developers, so they can develop a lot of applications based on software resources and embed them in the cloud, and making them available for cloud computing users[4].

C. Resource management layer

Is the key to achieve loose coupling of software resources and hardware resources. Through integration of virtualization and cloud computing scheduling strategy, on-demand free flow and distribution of software over various hardware resources can be achieved.

D. Service layer-

Has three levels of services namely, SaaS (Software as a service), Paas (Platform as a service), IaaS (Infrastructure as a service). In SaaS, cloud computing service is provided to customers. As is different from traditional software, users use software via the Internet, not to need a one-time purchase for software and hardware, and not to need to maintain and upgrade, simply paying a monthly fee[4]. The platform layer of e-Learning cloud With the support of the powerful hardware, platform layer carries out the tasks of data storage, computing and software development, and it can even achieve the tasks of completion of the original mass data storage, business intelligence processing and so on which have been difficult to complete. Users can choose the devices and the number of devices according to the complexity of dealing with the content. Virtualization technology enables the platform to show a strong level of flexibility[7].

E. Application layer

Is the specific applications of integration the teaching resources in the cloud computing model, including interactive courses and sharing the teaching resources. The interactive programs are mainly for the teachers, according to the learners and teaching needs, taken full advantage of the underlying information resources after finishing made, and the course content as well as the progress may at any time adjust according to the feedback, and can be more effectiveness than traditional teaching. Sharing of teaching resources include teaching material resources, teaching information resources (such as digital libraries, information centers), as well as the full sharing of human resources. This layer mainly consists of content production, educational objectives, content delivery technology, assessment and management component [11].

The applications software or services provided by a school or university, the students to pay in the similar way of on-demand access, according to the amount to calculate the cost, complete the production, marketing, trading and management. E-Learning cloud environment provides user-oriented ubiquitous adaptive hardware resources, computing environment and software services. In e-learning cloud space, users can access to digital services transparently at any time in anywhere. The users can obtain the necessary network and computing services very naturally at any position. The information space and physical space will be integrated because of ubiquitous computing capability. And the ubiquitous information terminals together with the embedded system equipment will be the vehicles of e-commerce in the future[7].

VIII. CHARACTERISTICS

1) In general, cloud computing customers do not possess the physical infrastructure, instead avoiding funds spending by renting usage from the third party supplier.

2) They consume resources as a service and pay only for the resources that they use.

3) Sharing “perishable and intangible” computing power among multiple tenants can prove utilization rates, as servers are not unnecessarily left idle.

A side effect of this approach is that overall computer usage rises dramatically, as customers do not have to engineer for peak load limits.

IX. CLOUD COMPUTING TYPES

A. Public Cloud

Public cloud or external cloud describes cloud computing in the traditional mainstream sense, whereby resources are dynamically provisioned on fine grained, self services basis over the internet via web applications, web services from an offsite third party provider who shares resources and bills on a fine-grained utility computing basis.
Private cloud and internal cloud are neologisms that some vendors have recently used to describe offerings that emulate cloud computing on private networks. These products claim to "deliver some benefits of cloud computing without the pitfalls", capitalizing on data security, corporate governance, and reliability concerns. They have been criticized on the basis that users "still have to buy, build, and manage them" and as such do not benefit from lower up-front capital costs and less hands-on management, essentially the economic model that makes cloud computing such an intriguing concept”.

C. Hybrid cloud

A hybrid cloud environment consisting of multiple internal and/or external providers will be typical for most enterprises. A hybrid cloud can describe configuration combining a local device, such as a Plug computer with cloud services. It can also describe configurations combining virtual and physical, collocated assets—for example, a mostly virtualized environment that requires physical servers, routers, or other hardware such as a network appliance acting as a firewall or spam filter.

X. GRID COMPUTING

Grid computing is a term for either of two broad subcategories of distributed computing:

A. Online computation or storage offered as a service supported by a pool of distributed computing resources, also known as utility computing, on-demand computing, or cloud computing. Data grids provide controlled sharing and management of large amounts of distributed data, often used in combination with computational grids.

B. The creation of a "virtual supercomputer" composed of a network of loosely-coupled computers, acting in concert to perform very large tasks. This technology has been applied to computationally-intensive scientific, mathematical, and academic problems through volunteer computing, and it is used in commercial enterprises for such diverse applications as drug discovery, economic forecasting, seismic analysis, and back-office data processing in support of e-commerce and web services.

XI. DIFFERENCE BETWEEN CLOUD COMPUTING & GRID COMPUTING

- Grid computing emphasizes on resource sharing, every grid node can apply for resource from other nodes, and every node should contribute resource to the grid. The focus of grid computing is on the ability of moving a workload to the location of the needed computing resources, which are mostly remote and are readily available for use. Grids also require applications to conform to the grid software interfaces.

- Cloud computing emphasize on proprietary, every user out of the cloud can get its own private resource from the cloud, and the cloud resource are provided by the specific service provider, the user need not contribute its resource. In a cloud environment, computing resources, such as servers, can be dynamically shaped or carved out from its underlying hardware infrastructure and made available to a workload. In addition, while a cloud does support grid, a cloud can also support nongrid environments, such as a three-tier Web architecture running traditional or Web 2.0 applications.

- Grid computing emphasizes on computing sensitive task, and is difficult to automated scale. Cloud computing emphasizes on transactional application, a great amount of separate request, and can scale automatically or semi automatically.

XII. CONCLUSIONS

The e-learning solution development cannot disregard the cloud computing trends. Cloud computing for e-learning solutions influences the way the e-learning Software projects are managed. There are explicit tasks that deal with finding providers for cloud computing, depending on the needs. Also, the cost and risk management influences the way the e-learning solutions based on cloud computing are managed. The amount of some public clouds across multiple legal jurisdictions further complicates this subject. These concerns are considered key obstacles to broader acceptance of cloud computing, making them areas of active research and argue among cloud computing practitioners and advocate. It has the major span to change the whole education system. In present situation the e-learning is getting the popularity and this application in cloud computing will surely help in the development of the education offered to people which will increase the quality of education offered to them. Cloud based education will help the students, staff, Trainers, Institutions and also the learners to a very high extent and mainly students from
rural parts of the world will get an opportunity to get the knowledge shared by the professor on other part of the world. Even governments can take initiatives to implement this system in schools and colleges in future and we believe that this will happen soon.

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