

Solution to implement e-learning system based on cloud computing

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Abstract— New information and communication technologies have impacted education system. E-learning as an important approach for today's education system used is one of the effects of new technologies. These types of training, suggests the use of information and communication technologies to improve the quality of teaching and learning through easy access to educational resources and services. Many educational institutions, does is not have.e-learning platforms, resources and infrastructure necessary to implement this type of training, the need for high cost of basic infrastructure and applications challenges related projects with which it has to face. The use of cloud computing can help to significantly reduce the cost of infrastructure, software and human resources. In the cloud computing resources and services are as a service over the internet, and easily tailored to the needs of the consumers. This technology for dynamic scalability and efficient use of resources has become an attractive technology. In this paper, we describe the concept of e-learning and cloud computing, how to implement e-learning system based on cloud computing, the efficient utilization of hardware resources and software in a learning environment.

Index Terms— Architecture,Cloud computing, E-learning, Software life cycle ,Saas

1 INTRODUCTION

Cloud computing is an emerging technology which is still hard to describe. A commonly cited definition comes from NIST is [1, 2]:

“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.”

The cloud computing becomes the host issue in industry and academia with the rapid development of computer hardware and software. The cloud computing is the result of many factors such as grid computing, distributed computing, parallel computing, virtualization technology, utility computing and other computer technologies[3]. The goal of this computing model is to make a better use of distributed resources and put them together in order to achieve higher performance, availability, reliability and extensibility [4, 5]. Service sharing is the main characteristic of Cloud Computing Systems (CCS), which distinguishes CCS from Grid, Cluster computing and other types of distributed systems [6].The on-demand, pay-as-you-go model creates a flexible and cost-effective means to access compute resources [7].

The idea is not new. In fact, the concept of today's cloud computing may date back to 1961, when John McCarthy, retired Stanford professor and Turing Award winner, delivered a speech at MIT's Centennial. In that speech, he predicted that in the future, compu-

ting would become a “public utility.”[8]

Yet for colleges and universities, the recent growth of pervasive, very high speed digital networks offers not

simply access to more efficient computing but rather a new capability and an opportunity to rethink approaches for delivering IT services. These networks are catalysts that point toward an evolving discontinuity in the point of origin for essential IT services [9].

There are several cloud computing services providers that offer support for educational systems. Among them are Amazon, Google, Yahoo, Microsoft etc.

In section II, the proposed architecture for e-learning system is expressed. In section III, the proposed solution is presented to implement the architecture and develop system and in the section IV, formulas to assess the parameters of the system will be presented.

PROBLEM DESCRIPTION & RELATED WORK

Along with the development of the students, educational content, services, resources needed, e-learning systems are growing at an exponential rate. Factors has been effective in the spread of this phenomenon; such as reduced training costs, ease of attending virtual classes, a variety of courses, selection time, reduce travel costs and increase the flexibility of e-learning. Although e-learning technology is very useful, but it's challenging for companies that are attempting to implement this technology. These companies continue to produce, optimize and upgrade software and hardware resources required for training and budget shortfalls have encountered many problems. Online courses require appropriate infrastructure and strong management and maintenance. Now e-learning sys-

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tems still are poor at the infrastructure stage because of the high development and resource management costs [10]. Several resources can only perform certain tasks when workload is high. These systems always need to add and configure new software and hardware resources and high flexibility of the system; otherwise you will bear a huge cost. Data storage for course participants, course contents, exam questions and save the end results of examinations, require massive storage space that not all institutions have the power to achieve it. The solution seems to be to modify the use of cloud computing to reduce costs and ease of system implementation.

Much architecture has been proposed in this issue. One of them [11] can be seen in figure 1. In this figure e-learning system based on cloud computing in the three layer architecture is shown.

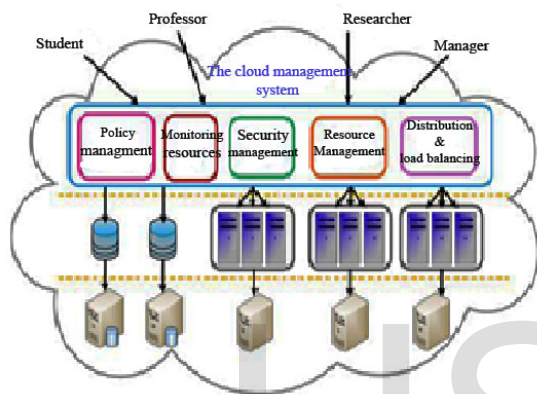


Figure 1. e-learning system based on cloud computing architecture

As shown in figure 1, the top layer is a cloud management system that interfaces between the user and the system resources that are put into the cloud. So on the one hand the user (researcher, teacher or student ...) and from other resources will be given. Capabilities to implement e-learning environment, this system includes the following sections:

1. **Monitoring resources:** monitors receiving requests, configuring and using the resources and their health or failure.
2. **Distribution and Load balancing:** is responsible for computational load on physical resources required to balance the load of virtual machines.
3. **Resource Management:** depending on requirements, increases or decreases the amount of resources.
4. **Security management:** monitoring login users, ensure the confidentiality and integrity of information and data and security of user's transactions.
5. **Policy management:** establishing and maintaining education and training policies, as well as the scheduling policies and resource allocation.

These parts together make up a cloud management system. Virtual machines are the second layer that according to the requirements can reduce or increase capacity and in the lowest layer there are physical resources and hardware in the data center [11].

The question that arises is how the system should be implemented and evaluated. In the next sections, we will answer these questions.

PROPOSED SOLUTION

In section II, the proposed architecture for e-learning system was expressed. In this section, the proposed solution is presented to implement the architecture and develop system.

Waterfall model of software development is a hybrid model where the production process has a steady flow downward (like a waterfall) toward the phases of software life cycle, such as requirements engineering, analysis, design, implementation, testing, deployment and maintenance [12]. This process is shown in figure 2.

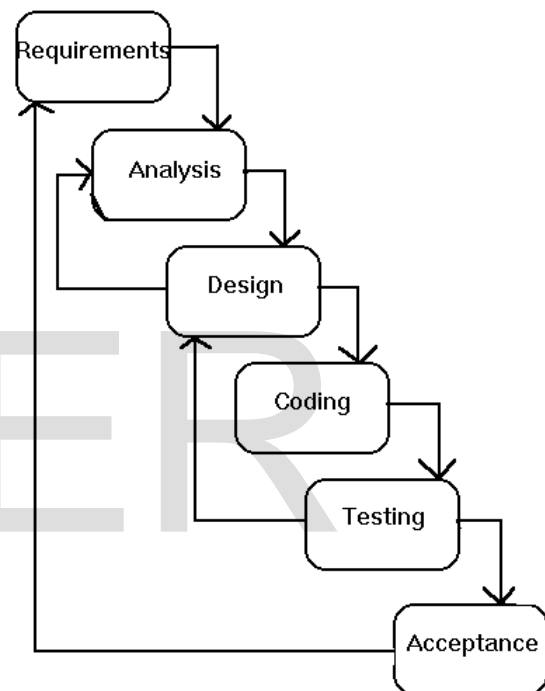


Figure 2. The waterfall model (Systems Development Life Cycle)

System production process steps are same as e-learning system based on cloud computing. Requirements engineering process characterizes all projects needs and functional characteristics of e-Learning systems and the goals that must be met, will be described. This step should take care of the strong correlation between project objectives and the scope of the project because any deviation from project goals will have a significant impact on the efficiency of the cloud education system. In the proposed solution, users' needs regardless of the concerns of optimum hardware and software resources are provided. If demands change, no additional costs are needed. The system can be changed at any time, without any more cost; because cloud systems are independent of the implementation environment and making changes to create or upgrade the hardware and software is not necessary at the user side and the system is very flexible [13].

In the design phase, a model for quality assessment is made. Design for web applications, including applications that run in the cloud space, including technical and non-technical activities include: determining a web application,

creating aesthetic user interface, defining the overall architecture, content development and operational capability of the architecture discovering design within the web application [12].

Considering the cloud computing infrastructure will be rented from the service provider, the project manager's focus moves from choosing the right technology to choosing the right vendor. Instead of concentrating on the computing power of the architecture and the costs of scaling up the e-learning system, the project manager will be looking at such parameters as service availability, data security [14]. The proposed system has two types of design: server system design and client system design.

Client systems do not require complex design, the need for special hardware and software in these systems is not and the proposed architecture for implementation is not tied to any particular platform. The only need is Internet connectivity. Cost estimation and cost budgeting project processes are highly biased because of the cloud computing architecture. The service supplier absorbs up-front costs and spreads the costs over a longer period and over several cloud computing customers. Thus, the initial capital expenditure of the project is converted to ongoing operational expenditure of the e-learning system maintenance [14].

Because of the millions of pre-built software and databases on the cloud and combination capabilities, education system coding is not complicated and workload is low. Users with access to the Internet without restrictions of time and place can easily make use of a wide range of services. However, due to platform-independence and platform-free cloud services, there is more freedom in selecting programming languages [15].

The test is a set of related activities that follows: to discover content errors, operational capability, usability, surfing, efficiency, program's security. Encountering application errors, disrupt user loyalty and so before any program failure the maximum number of errors must be removed [12].

Cloud education system testing, as well as other systems can be performed at all stages of the project. Cloud computing systems are free from hardware and special software on the client side. A service failure in the tests and the need to change the service or modify the software and hardware, without incurring large costs to the system, can easily be done.

One of the concerns of the manufacturer's web applications is coordination of system hardware and software supplied with client software. Hardware and software platform resources provided by the cloud service providers, in a cloud computing system, these concerns have been deleted and correcting most of errors at the server side results in better speed and cost. Cloud software is web and free from Geographical constraints so debugging is very difficult and the use of cloud technology is very useful in order to facilitate this process. [16]

In the establishment and supporting cloud system, computing infrastructure is not costly and does not require hardware and software resource.

ASSESSMENT

Nowadays there is a strong correlation between users and personal computers that eliminate this dependence using cloud. Users have the same results using any internet connection and access to a cloud server with minimum software and hardware.

Users of these systems take a variety of services such as business, education, entertainment, etc. Proposed architecture and its implementation have been described for cloud e-learning system. The proposed system is used to provide educational services. In the following, formulas to assess the parameters of this system will be presented.

Availability

When using this software, users expect the service to be available with minimal delay. Software availability is "likely to work out a plan according to user requirements in a given point of time" [12]. Even the best programs on the web, if not available, cannot provide the needs of users. From a technical perspective, the availability is amount of time available for the web application. End user expects it be available twenty-four hours, seven days a week, 365 days a year. Anything else is unacceptable.

The following formula can be used to calculate this parameter.

$$A = \frac{MTTF}{(MTTF + MTTR)} * 100\%$$

A = system availability

MTTF(mean time to failure) = mean time a part of a system crashes after the start of its first run. The damage is such that other systems cannot operate normally.

MTTR(mean time to repair) = mean time to repairs.

As is known, the parameters in the formula can be calculated and so we can easily calculate the system availability.

Security

Web-based applications, including cloud applications, collaborate and highly correlate with corporations and government databases and save clients critical information so security programs in many circumstances are of fundamental importance. Cloud system ability to exclude non-permissible achieve or prevent intrusion attacks is key solution. In the proposed system, the data security can be measured using the following formula [14].

$$DS = \frac{DA}{TNA} * 100\%$$

DS = the security degree of the e-learning system, measured in percents;

DA = the number of successfully denied attacks upon the e-learning system during a year;

TNA = the total number of denied attacks upon the e-learning system during a year.

Fault Tolerance

Communications planning means deciding what project processes and tools will be used for timely and

appropriate generation, collection, distribution, storage and retrieval of project information. More exactly, this means setting up the reports that have to be generated, their content and frequency. Also, this implies setting up a bug tracking system for recording all the issues that arise during e-learning system development. The ration of bugs to the total number of features developed is called bug-feature ration:

$$\text{BFR} = \text{Bugs/Features}$$

where:

BFR – the ration between the number of bugs (defects) discovered and the number of features developed. This metric show how many bugs are there for every developed feature;

Bugs – the number of defects found in the system;

Features – the number of features developed according to the project plan.

In view of the above formula, we can offer some quality attributes such as availability, security and fault tolerance will be measured.

CONCLUSIONS

We are looking for an e-learning system, class or institutional infrastructure cloud computing are. E-learning development can not ignore the trends in cloud computing. Pioneers in the field of information technology, cloud technology as a factor in the loss of concepts such as personal computer in the near future. Soon the word "PC" will not be used for personal computers, but it is a personal cloud for the term "personal cloud" is used. Using Clouds for e-learning systems has many advantages. The application of e-learning systems are growing and looking for a variety of end users programming model for writing and developing their application. Integration of cloud computing with the advanced features of e-learning in a variety of programming models, performance of service, application services and provides dynamic resource provisioning. Cloud computing features such as reduced costs, improved reliability, simplicity, scalability and faster time to process integration for educational institutions provide. Cloud computing to support different programming models for developing applications in e-learning is a good option.

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