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A Framework on Dynamic Resource Allocation for Cloud Based e-Learning

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Abstract
Cloud Computing is a novice technology and it is very familiar among IT users by providing its large variety resources among its consumers. The E - learning program brings a brand fresh concept and is a kind of network information learning mode and also known as online learning to direct teaching. E-learning accentuates on the technology to transform and guide education. This paper gives a clear idea how e- resources are allocated dynamically in a cloud environment. It clearly shows the overview of dynamic resource allocation strategies used in e learning The Research is done to traverse over the problems in the resource allocation such as resource contention, resource fragmentation. It also reduces network traffic and internet flash crowd problems that are available in the cloud. This architecture, comprises three major parts and they are Workload Analyser, Priority Scheduler and Accountability Monitor. Workload Analyser predicts the bursty workloads from the user requests. Priority Scheduler is used to schedule the requests of the user. Accounting Monitor is used to generate the cost for the required resources in a dynamic resource allocation. . In the future, we can validate and use the test cases to prove this conceptual framework for dynamic resource allocation on e-learning. It is thought that this report would benefit both cloud users and researchers in overcoming the challenges that are faced in the e-learning environment

Keywords
Cloud Computing, Resource Allocation, e-learning, Contention, Fragmentation.

I. Introduction

In an IT Industry, there are many technologies that are developed and are used by the number of end users. Main Objective of all types of technologies is to satisfy the needs of the customers. In computers we are having technologies such as cluster, grid, etc. In order to master these difficulties of advent technologies, the new technology was discovered and it is a boon for the IT industry and it is called cloud computing. Cloud is one of highly creditable and most valuable technology in computer science. Cloud computing, has directed at allowing access to great amounts of computing power in a fully virtualized mode.

Vaquero et al. [1] Have stated that clouds are a great pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized Service Level Agreements (SLA).

D. Gmach et al. [2] have stated dynamic resource allocation as Increased awareness of energy consumption in data centers has encouraged the practice of dynamic consolidating VMs in a fewer number of servers. In cloud infrastructures, where applications have variable and dynamic needs, capacity management and demand prediction are especially complicated. This fact triggers the need for dynamic resource
allocation aiming at obtaining a timely match of supply and demand.

E-learning is an Internet-based learning process, using internet technology to plan, select, implement, manage and extend learning, which will not replace traditional teaching methods, but will greatly improve the efficiency of education [3].

This paper presents the conceptual framework model for dynamic resource allocation in e-learning and it is applied in the cloud environment. This framework can be implemented for handling large requests for e resources and it likewise serves to reduce internet flash crowds, internet Traffic. Bursty workload management, handling multiple SLA parameters, priority based scheduling mechanisms, and accounting monitor, these are all-important characteristics in this framework model. This paper is organized as follows: In Section II we present and discuss relevant works related to our proposed architectural framework.. In Section III we analyze the proposed framework for dynamic resource allocation strategies in an e-learning architecture with the perspective in a cloud environment. Section IV presents our conclusions and future works of this proposed architecture.

II. Related Works

Md. Anwar Hossain Masud et al. [4] Had proposed architecture for e-learning based on cloud computing, it brings out the characteristics of the current E-Learning. Then it analyses the concept of cloud computing and describes the architecture of cloud computing platform by combining the features of E-Learning. Cloud computing can aid communities and nations, can transform education. An entire world of knowledge can immediately be made available to teachers and students through cloud based services that can be accessed anytime, anywhere, from whatever device. By helping countries worldwide, bringing down the cost and modifying the delivery of educational services, cloud computing changes students throughout the world to win the educational accomplishments and preparation they require to compete and win in the worldwide information society.

Utpal Jyoti Bora et al [5] had proposed benefits of using cloud computing for e-learning. There are masses of educational establishments that cannot afford such investments, and cloud computing is the best answer, particularly in the universities where the function of computers are more intensive and what can be sufficed to increase the benefits of common applications for pupils and instructors. Cloud based education will serve the students, staff, Trainers, Institutions and also the learners to a very high extent and mainly students from rural parts of the world will find an opportunity to acquire the knowledge shared by the prof in

another region of the globe.

Aida Ghazizadeh [6] have proposed an architecture for cloud based e-learning and narrated its benefits of utilizing the model for cloud based e-learning Merits of this model is cost effective for the implementation of the hardware and software and this engineering can improve quality of the current arrangement of education at an affordable price. The universe of cloud computing is shifting daily and In the future, it can switch the whole education system and will certainly aid in the growth of the E-Learning.

L. Shyamala et al [7] had suggested that Cloud computing is a splendid substitute for educational foundations which are particularly under budget deficit in order to control their information systems effectively without dropping any more capital expenses for the computers and web devices. They had reviewed the purpose of cloud environment in the educational field in particular, particularly in the universities where the use of computers are more intensive and what can be executed to maximize the usage of resources available in the formal infrastructure. This automatically cuts the monetary value of organizational expenses and puts up more powerful functional capabilities. Cloud computing has the potential to inspire the computing facilities, institutions provided to their students in a cost efficient manner. In that respect are different open source technologies which are usable to build private cloud within college, school campuses. Private Cloud can offer students with desired computational facilities on demand without any disbursement. They had presented optimal job

Scheduling mechanism in IaaS (Infrastructure as a Service) cloud systems for personalizing the scheduling based on the use pattern.
D. Kasivishwanth et al [8] suggested cloud based e-learning is the subdivision of cloud computing for educational field for e-learning systems. Hereafter for e-learning technology and its infrastructure, cloud based e-learning has all the provisions like hardware and software resources to increase the conventional e-learning infrastructure. In one case the educational materials for e-learning systems are virtualized in cloud servers these materials are approachable for use to students and other educational concerns in the form of rent base from cloud vendors

Mendez [9] illustrates that in traditional web-based reading mode, system construction and maintenance are located inside the educational institutions or enterprises, which contributed to a set of troubles, such as significant investment required but without capital gains for them, which contributes to a lack of growth potential. In contrast, cloud-based e-learning model introduces scale efficiency mechanism, i.e. Construction of e-learning system is entrusted to cloud computing suppliers, which can make providers and others to achieve a win-win Situation. The cloud-based environment supports the creation of a new generation of e-learning systems, able to run on a wide range of hardware devices, while storing data inside the cloud.

Paolo Cemim et al [10] had proposed Educloud, an academic, private cloud tool that provides a simple environment to comprehend and experiment cloud computing concepts. It can be easily deployed using standard local computing resources, without the demand for extra hardware or access to outside resources. It also enables the deployment of a private cloud using heterogeneous resources, composed by common hardware usually found in academic environments. It performs various tasks associated to the management of a cloud infrastructure, serving as an option to demonstrate the concepts of cloud computing. The architecture of Educloud is divided into five primary components: Cloud Controller, Node Controller, Centralized Storage, API Control and User Interface.

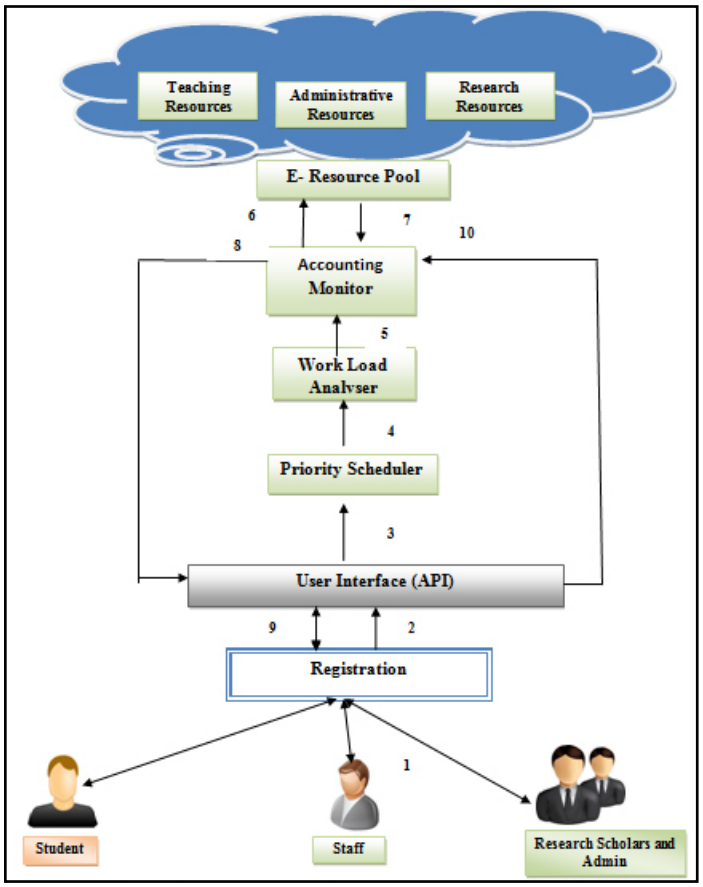

Fig. 1 : Architecture for Dynamic Resource Allocation in cloud based e-learning.

III. Architecture for Dynamic Resource Allocation for Cloud Based e-Learning

In these purposed architectures, we can dynamically allocate the e-resources for different types of users i.e. Staffs, students, research scholars and programmers. The Architecture can be divided into the following layers they are user registration, workload analyser, Accounting monitor, and e-resource pool.

1. User Registration

It is the initiative phase in the architecture and it mainly carries the username, and Id. Every user will be presented a separate ID to access the e resources and it also sorts out the different characters of users based on the user specification. User Details are entered in the database by using the User Interface (API) tool for accessing the e-Resources.

2. User Interface

User Interface acts as an intermediate between the resource allocator and the user. It mainly incorporates the user details, it identifies what type of user (i.e. Staff, student, etc.). User Specifications usually contain total no of resources in need, time, and durations for the utilization of the resources. It communicates with the workload analyzer to avoid the burstiness in user requests.

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It also communicates with the accounting monitor for economic constraint.

3. Work Load Analyser

Whenever the user completes the registration process in the user interface layer, it automatically analyses the user requests and manages the bursty workload on demand requests from the user. It mainly enhances and maintains the operation of the organization by handling highly on demand resources. Burstiness has been recognized as an important characteristic of traffic in communication networks and has fueled much research over the past two decades. Recently, the presence of burstiness has also been identified in a variety of settings, including enterprise systems, grids, storage systems, and file systems. Thus it is necessary for this architecture to include burstiness aware resource allocation policy to handle burstiness in the user requests. Burstiness mainly occur when there number of requests for the particular resource or virtual machine server, the server automatically becomes slow and it degrades the performance of the system.

To resolve the problem we present smart load balancer, which leverages the knowledge of burstiness to anticipate the changes in user demands. User on demand requests are managed by using static and online adaptive resource allocation mechanisms. It primarily uses two selections random and greedy (best) based on the predicted user requests. Greedy mechanism only selects the requests with the shortest queue length (i.e. Requests in less time duration for utilization of e-resources). Random based selection is done by calculating the average queue of the resources and selection is done within the limit. It analyses the job completion time and sends the requests for the resources to priority scheduler. However, burstiness in user demands often dramatically degrades the application execution. And then this mechanism is included in this architecture to satisfy peak user demands and meet Service Level Agreement constraints (SLA) and efficient resource allocation systems are highly demanded in the swarm. This component mainly tunes the load balancer by adjusting the trade-off between randomness and greediness in the choice of sites. On Demand requests from the user for the e-resources is processed in workload analyzer and it breaks to priority Scheduler Phase.

4. Priority Scheduler

After analyzing requests from the workload analyser, the requests from the user automatically moves to the priority scheduler. It is one of the most vital elements in this architecture, it processes the tasks and user requests on priority base. Priority based Scheduling is used to increase the resource utilization in the cloud based e-learning environment. Resource provisioning is performed by considering the Service Level Agreements (SLA) and with the aid of parallel processing. In this process earliest start time (EST) and Deadline (dl) is estimated for execution of the jobs. Earliest start time is approximated by the user and it is the beginning point of the resource utilization. Deadline (dl) is the ending time of the resource utilized by the user. Hence, by considering multiple SLA parameter and resource allocation by preemption mechanism for high priority task execution can improve the resource utilization in the Cloud. Multiple SLA parameters are network, bandwidth, CPU, Latency time and throughput.

5. Accounting Monitor

Later on the completion of scheduling process, the price is generated for the requested resources from the service Provider. Accounting Monitor requests the e-resource pool for the resources and it also gets permission to access the e-resources based on the time and economic constraint. In Accounting Monitor the price is generated by using three parameters they are starting time, task execution time and ending time. Penalty charges are also levied from the consumers, when they are utilizing the resources beyond the time limit. Accounting Monitor also checks the payment gateway by which the consumer can pay for the resource utilization.

It works as an intermediate between user interface and e-Resource Pool, from the accounting monitor the user can able utilize the e-resources from the avail supplier. It also checks the requested resources are available in the e-resource pool and it provides the resources for its consumer.

6. E-Resource Pool

It is composed of four layers such as Teaching Resource layer, Administrative Resource Layer, and Research Resource Layer. In this e-resource pool, the consumers get their required educational resources and it is the last stage in this architecture. Teaching Resource layer mainly promotes the application of the cloud intelligent learning platform, perfect the education service system (such as students, teachers, users' visualization application and operation). Administrative layer is used by admin to control all the resources stored in the resource pool. It is to strengthen resource anatomizing and sharing, management and monitoring, including large knowledge bases, data center, automatic building middleware, and so on complex information dealing, its goal is to improve the performance of information processing and control overall functioning of the system. Research resources it is utilized by the research scholars for the academic research purpose.

Teaching Resource Layer

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

In teaching Resource layer is accessed by students and teachers, it enables to enhance the personalized learning environment to the students. Teacher creates the content and delivers to the students in an interactive way, so it attracts the students to learn the content easily and effective manner. Students can give feedback to the teachers and the assessment is done by using effective tool in a continuous progress.

Limited budgets can be used to build a prospective education information platform, to change the scattered private resources for centralized sharing cloud resources, change the scattered management for centralized management. Through the education gateway provides customized information technology services to the educational institutions in the region and the user can effectively solve the problem of insufficient school IT talents, to safeguard the stable operation of the system. They can not only carry out online collaborative research, create and share the network teaching resources with other teachers, but also can

access student attendance and report management application, so as to reduce duplication, to avoid mistakes.

Administrative Resource Layer

This layer realizes the resource sharing service between clouds through the cross-platform software and middleware technology, fast and efficiently to access the school information resources of the service area using education cloud gateway platform, so that the area of the education information level to realize general improvement and balanced development. Service Interface layer mainly is composed by operating system and middleware. Through middleware technology, a variety of software resources are integrated to provide a unified interface for software developers, so they can easily develop a lot of applications based on software resources and embed them in the cloud, making them available for cloud computing users.

Research Layer

It is mainly comprises of research resources and it enables to access the leading research articles and journals in an effective way. It mainly benefits for the research scholars for their research activities. Leading journals can be accessed in a very least number of costs and it enables the research scholars to upload their research articles and they can also get the feedback from their research supervisors.

7. Working of the Proposed Architecture for Dynamic Resource Allocation for cloud Based e-Learning

1. Registration is done it is used to classify the different types of end users for this application. End users are staff, students, Research Scholars and administrative personals.
2. After Registration phase, the control goes to User Interface in that the user entries are registered and separated log is maintained for the resource specification from the user.
3. User specification details are entered in the API (Application Programming Interface) and the requests are made to the Workload Analyser. It is used to handle multiple requests to avoid network traffic Problems.
4. After analyzing the bursty workloads, the resources are allocated to the user by using priority scheduler. Scheduling is done to maximize the profit and to satisfy the minimum service level to the consumers.
5. In Accounting Monitor, the price is generated to its consumers, based on the requested resources, it also checks whether the allocated resources are available in the e-resource pool.

IV. Conclusion And Future Works

Cloud computing is a recently developed advanced Internet-based computing model. By combination of cloud computing and e-learning, building cloud-based e-learning system opens up new ideas for the further development of e-learning. The primary intention of our proposed architecture is to use our limited resources in a most efficient way. Cloud computing as an exciting development is a significant alternative today's educational perspective.. 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.

This architecture helps to avoid resource allocation problems such as resource contention and scarcity of resources. It also manages bursty workloads and it can handle peak of multiple requests without any network failure or traffic problems. In future this architecture can be extended with implementation in a cloud environment. It can be proved by developing test cases and simulation tools must be created to implement this architecture.

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