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Multi Objective Self Analysis Model Based Service Selection For User Interactive E-Learning In Cloud Environment

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Abstract

The development of information technology has provided support to many solutions and opened the gateway for many complex solutions. Now a day video conferencing has become more popular which is applied in different area and similar methods are adapted in various other problems. E-learning is the method of learning through electronic devices like internet computers, mobile devices and many more. The concept of E-learning has arrived at 1990's and has good impact in various sectors, even universities provides E-Learning in their course offered. The problem of E-Learning is faced by user growth and the size of memory required by the organizations. The E-Learning organizations are not prepared to such infrastructure which costs more. The recent development of cloud technology has more solutions to provide E-Learning services which could be accessed by the cloud users. The success of technology accommodation is highly based on the understanding of the learners or cloud users. The learning system has to be monitored and the efficiency of the system has to be measured in more strategic manner. I name the cloud services dedicated for E-Learning as E-Cloud Learning service. To perform such analysis, I propose a novel self analysis model which performs analysis about the different E-Cloud learning services. There are many institutions or tutors provide learning services, or the same institution may has number of tutors for the same topic. The user will be allowed to access the E-Cloud learning service and at the end of the seminor the user will be asked with random generated questions about the topic of discussion. From the result provided by the user, the service will be ranked and analyzed about the

knowledge gathered by the learner. The user will be allowed to choose a service from list of similar service which are ranked according to the user understanding factor and the number of learn stream and so on. The proposed model performs analysis of their own E-Cloud service to provide efficient E-Learning system to the users of the university and performs modification in their services provided. The whole facility comes to functionality with the support of cloud service providers who becomes the heart of the cloud environment.

Index Terms: E-Learning, Cloud Computing, E-Cloud Services, Self Analysis Model, Interactive Learning.

Introduction

E-learning is a type of learning subjects through electronic technology like internet, mobile devices, and PDA devices. Many universities conduct their courses in distance method and the students enrolled can learn the courses through electronic methods. Even the students can write their examinations through internet, which makes the learning easier. The problem is to offer more courses and to control them in strategic manner is not feasible for the educational sectors which require more resources which is costlier.

The recent development in cloud computing is the exact solution for E-Learning where the user does not need to go by person they can access the cloud services which are E-Cloud services through online. The examinations also can be conducted online, the user can access the service provided by the service provider based on their enrollment in the university. The user can access the services and at the end of session the user will be asked by random generated questions to measure the understanding of the user. The results entered by the user will be used to analyze the understandability of user and also used to analyze the E-Cloud model and the tutors of the E-Cloud Learning System.

E-Cloud Services are cloud services which provide reference to the user to access the course which is available in form of web document or video's or video conferencing. The universities may conduct the course in distance mode and the seminar could be access through E-Cloud service which is in form of video conferencing mode. At the end of session the learners will be asked with set of questions and the cloud user has to answer the questions. The selection of student and the question is performed in random manner by the E-Cloud system.

The same subject may be taught by many professors and the way of teaching differs with individual and the student understanding also varies between the tutors. So the self analysis model has to take care of providing exact reference to the cloud students based on their understandability. The service has to be ranked in such a way that the users could understand the subject and able to answer the questions accordingly.

Related Works:

There are many approaches has been discussed for E-Leaning and Cloud computing. We discuss few of them in this chapter.

Cloud-Based E-Learning: A Proposed Model and Benefits by Using E-Learning Based on Cloud Computing for Educational Institution [1], discuss the current state and challenges in e-learning and then explained the basic concept and previous proposed architectures of cloud computing. In this paper authors also proposed a model of cloud-based e-learning that consists of five layer, namely: (1) infrastructure layer; (2) platform layer; (3) application layer; (4) access layer; and (5) user layer. In addition to this paper we also illustrated the shift paradigm from conventional e-learning to cloud-based e-learning and described the expected benefits by using cloud-based e-learning.

The Cost Effective Structure For Designing Hybrid Cloud Based Enterprise E-Learning Platform [2], provides a cost effective structure of hybrid cloud architecture that has been implemented the multi-tenant model for enterprise to support customization sharing among different virtualized applications in a tenant area. The schema-sharing and multi-tenant data storage architecture also supports the learning content delivery. The important basis for the design method of software development shall embed with the cost effective structure, such as using multithreads to compute background processing and unzip the content files to reduce brand width usage. Even the file sizes of learning content shall be zipped to the less small size and duplicate to different servers for cutting down the traffic flow of brand width. The detailed calculation of the all I/O computer processing and brand width become the crucial implementation way.

Implementing Motivational Features in Reactive Blended Learning [5], presents a significant advance in a reactive blended learning methodology applied to an introductory control engineering course. This proposal was based on the inclusion of a reactive element (a fuzzy-logic-based controller) designed to regulate the workload for each student according to his/her activity and performance. The contribution of this proposal stands on the inclusion of elements related to motivational factors in the students. Student motivation has been widely identified as a key factor for the academic success of every teaching-learning activity.

In BlueSky Cloud Framework: An E-Learning Framework Embracing Cloud Computing [8], physical machines are virtualized, and allocated on demand for E-Learning systems. Moreover, BlueSky cloud framework combines with traditional middleware functions (such as load balancing and data caching) to serve for E-Learning systems as a general architecture. It delivers reliable, scalable and cost-efficient services to E-Learning systems, and E-Learning organizations can establish systems through these services in a simple way. BlueSky cloud framework solves the challenges faced by E-Learning, and improves the performance, availability and scalability of E-Learning systems.

E-learning can be referred to as “education through electronic media”. It is one of the most emerging concepts in the field of technology. E-learning systems can be either synchronous or asynchronous. Agent based e-learning is helpful in managing the information overload, it can serve as academic expert and manages creation of

programming environment for learners. There are many characteristics that an E-learning environment has to support; they are Interaction, Data Security, User Personalization, Adaptability, Intelligence, Interoperability, Accessibility and User Authentication. E-learning must also support a few other features like cost effectiveness, reusability, storage capacity, powerful computing and virtualization which can be provided by Cloud computing. The Cloud computing Architecture is built using three models, Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS), which provides a variety of services. This proposed A Generic Agent Based Cloud Computing Architecture for E-Learning [9], architecture integrates the features of Agents and Cloud Computing to produce an Agent based Cloud Computing Architecture to enhance e-learning.

Shareable E-Learning Platform based on Cloud Computing [12], introduces Cloud computing into an e-Learning platform to allow the integration of different e-Learning standards to enhance interoperability of learning objects. By combining the characteristics of e-Learning and approach of Cloud computing, educators have not to re-construct learning objects to satisfy e-Learning environments developed from different e-Learning standards.

Budget-Aware e-Learning Systems on Cloud Computing Environments: A Genetic Approach [16], algorithm that allows the learner to find the best curriculum that fits his budget is introduced. This algorithm is proposed for cloud computing environments that have the concept of pay-per-use. Genetic algorithms are adopted in the proposed solution. The proposed algorithm is able to find the best set of learning objects that constitute the required curriculum. The returned curriculums have the best available experts' rank and fit learner's budget. Simulation results show that the proposed algorithm is able to find solutions very close to optimal solutions and in most cases identical to them.

A New framework Semantic Web Technologies based E-learning [13], present study about how to extract the useful information on the web and also give the superficial knowledge about semantic web and categories. This paper describes a previous model for E-Learning and proposes a new framework for the same.

Towards an Effective Integrated E-learning System: Implementation, [14], presents a new blended e-learning model and quality assurance framework for an efficient implementation in higher education with concentration on online engineering. In addition, a new integrated competency level is presented to ensure the teacher/instructor readiness for the new e-learning environment. The proposed model and framework successfully incorporates all the above elements.

All the above discussed approaches has the problem of identifying the exact E-Cloud services and has to problem in constructing the service than verify them.

Proposed Method:

The proposed self analysis model has various stages namely Service Ranking, Multi Attribute Analysis, Service Selection. Each functional module has dedicated jobs and will be discussed in detail here.

Service Selection:
The service selection from available service set is performed based on the number of learn stream and understanding factor. The number of learn stream represents the number of times the E-Cloud service has been accessed and understanding factor represents the understandability provided by the service. The understandability factor is computed using number of times the service accessed, total number of question raised and the total number of correct answer submitted. Based on all these attributes the service understandability measure is computed. The computed learn stream measure and understandability measure is used to compute the service weight based on which a single service will be discovered.

Algorithm:

Input: Service History sh, Service Request SR.
Output: Selected Service Ser.
Identify similar services SS.

$$SS = \int_{i=1}^{size(sh)} \sum Service \nexists SS$$

For each service Si
Compute number of learn stream Ls.

$$Ls = \sum SR.ID \in Sh$$

Compute number of questions raised Noq.

$$Noq = \int_{j=1}^{Ls} \sum Question \in (Sh(Sr))$$

Compute number of correct answers NCA.

$$NCA = \sum \int (Answer(quest.) == True, 1,0)$$

Compute understandability measure Um.

$$Um = \frac{Noq}{NCA} \times 100$$

Compute service weight sw = Ls×Um
End.
Select most weighted service Sr.
Sr = Sr(max(sw)).

The above discussed service selection algorithm identifies the number of learn streams, number of questions raised and number of correct answer provided. Using all these the method computes the understandability measure and service weight.

Multi Objective Self Analysis:
The E-Cloud environment provides various services for the same topic. Many professors may provide the same subject which can be accessed by the cloud environment. For each service of similar type, I compute the service acceptance measure based on the access history of the service. The service acceptance measure is computed based on the number of service access and the number of repeated selection of service from the same user. The computed service acceptance measure is used to analyze the service available.

Algorithm:

Input: Service History sh, Service sr.
Output: service acceptance measure Sam.
Initialize Sam, service acceptance count sac.
Compute total number of access.

Nos = $\int \sum Sr \in Sh$

Compute number of repeated access.
Compute distinct users. US.
US = $\int_{i=1}^{size(sh)} UserId(Shi) \nexists Us$
For each user Ui from Us
Compute number of access by Ui.
Nra = $\int \sum Sh\big(Sr(Ui)\big) == Ui$
If Nra>1 then

sac=sac+1.

End.

End.

Compute service acceptance measure Sam = $\frac{Nos}{sac}$

The above discussed algorithm computes the number of repeated access for each of the service available and based on that I compute the service acceptance measure for each of the service.

Service Ranking:

Whenever a user request comes, the self analysis model computes service acceptance measure using self analysis model. For each service available for the similar services, I compute the service acceptance measure and based on the service acceptance measure the services are ranked and produced as a result for the user. The user can choose any of the service and access them to learn the topic. At the end the user will be asked with set of random selected questions and the answers from the user will be received and stored to the service log. For each service access and the session result and service log will be produced.

Algorithm:

Input: Service History sh, Service Request Sr
Output: Ranked Results RR.
Step1: Initialize ranked results RR.
Step2: Identify similar service Ss

SS = $\int_{i=1}^{N} \sum ServiceID(sh) \nexists SS$

Step3: for each service Sri from SS

Compute service acceptance rate sar.

End
Step4: Sort service set Ss according to Sar.
Step5: produce result to the user.
Step6: Generate random questions Qs to users
Step7: for each question Qi

Receive answer QA from user.
Compute number of correct answer NoCA.
End.
Step8: Generate log to the service history.
Step9: stop.

The service ranking algorithm, I compute the service acceptance rate for each of the service they will be ranked accordingly. Finally a single service will be selected and given to the user and the feedback will be collected and logs will be generated.

Results and Discussion:

The proposed multi attribute self analysis model based service selection approach has been implemented in hadoop and the efficiency of the method has been analyzed. The proposed method has produced efficient results in all the factors of quality of service.

Table 1: Implementation Details of Proposed Method

Parameter	Value
Domain of Implementation	Hadoop
Programming Language	Advanced Java
Number of services	250
Number of users	2000

The Table 1, shows the implementation details of the proposed multi objective self analysis model for efficient E-Learning in cloud environment. There are 250 e-learning services available and I consider about 2000 users. The services are deployed in Hadoop environment and the lookup has been performed by advanced java.

Service Availability:

The service availability is the parameter which represents how efficient the service is assigned on requesting. It is computed based on number of times the service request has been received and how many times the particular service has been assigned.

Service Availability SA = $\frac{Number\ of\ times\ service\ Assigned}{Total\ number\ of\ request\ received} \times 100$

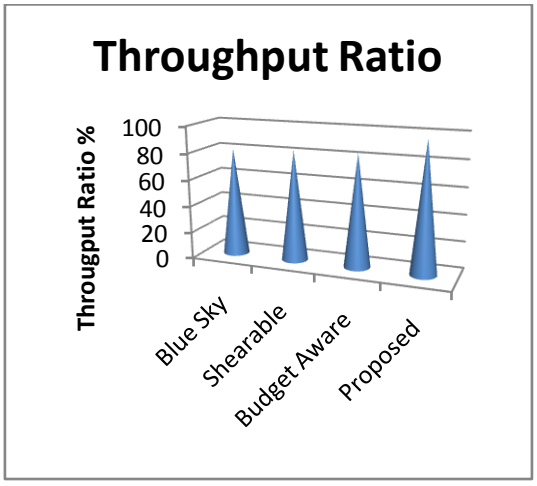
Graph 1: Comparison of service availability

The graph1 shows the comparison of service availability measured between different methods. It shows clearly that the proposed method has produced higher service availability than other methods.

Throughput Ratio:

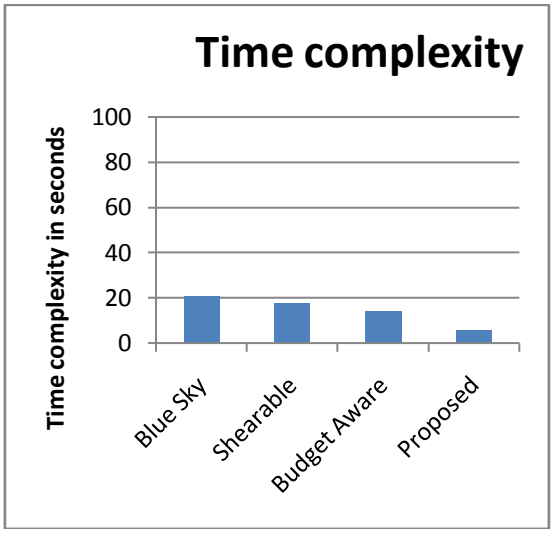
The throughput is the ratio computed based on number of times the service has been assigned and the number of times it has finished successfully.

Throughput Ratio TR = $\frac{Number\ of\ times\ finished\ successfully}{Total\ number\ of\ times\ assigned.} \times 100$



Graph 2: Comparison of Throughput Ratio

The graph2 shows the comparison of throughput ratio achieved by different methods. It shows clearly that the proposed method has produce more throughput than others.



Graph 3: Comparison of Time Complexity of Different Methods

The graph 3, shows the comparison of time complexity produced by different methods and it shows that the proposed method has produced less time complexity than others.

Conclusion

We propose a novel multi attribute based self analysis model for user interactive service selection to improve the performance of E-Cloud learning system. The method computes the service acceptance measure using various attributes of service from the service history. Based on computed service acceptance measure, the similar services are ranked. Finally the user will be allowed to choose a single service and the user can access the service finally the user will be asked set of random generated questions. The answers for the questions are received and complete the measure using which the services are ranked. The proposed method produces efficient results in all the factors of quality of service of cloud computing. The proposed method has reduced the time complexity of service access than other methods.

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