AN ADAPTIVE AUCTION-BASED CLOUD SELECTION APPROACH ON MOODLE VIRTUAL CLUSTER USING JMETER

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***Abstract*—** Moodle is the widely used platform for learning. Research is being carried out under moodle physical and virtual cluster. Since several years this manuscript is based on moodle physical cluster load balancing. A novel approach with cloud support has been presented where goodness of auction is included. A new idea of load regulator is highlighted to adjust balance between cloud memory and local memory. Later in result section proposed work is simulated on Jmeter. To make the proposed work more optimized, research is open.

Keywords- *Moodle; Virtualization, Cluster, Aution based Approach, Resource allocation.*

1)INTRODUCTION

Moodle[1] is an acronym for modular object oriented dynamic learning environment which is an open source software developed for learning management systems which is used for distance learning or online learning in universities, schools, professional firms, etc. Basically it was developed for educators to provide online courses which focuses on collaborative and interactive construct of the content with continual evolution. It is widely used due to its simple operation as well as flexible space expanding capability. When the moodle[2] system is introduced and the number of users exceeds the threshold value, single server fails to handle the increased load, which should be shared by multiple servers. This is done using a server cluster when such a case arrives.

1.1) CONDITIONS

Advocates highlight important advantages, such as:

- Lower total cost for ownership
- Higher levels of security
- Peer review
- Greater flexibility
- Ability to customize by modifying code
- Audit ability and code availability
- Technical support
- Well-tested updates and plug-ins
- Variety of capabilities and tools

1.2) CLOUD COMPUTING

It is the use of network of remote servers hosted on the internet to store, manage or process data instead of a local server or a personal computer. It enables the users to consume resources as a utility rather than having to build computer infrastructure at their home.

Cloud computing services[4] are divided into three broad service categories: Infrastructure as a service (IaaS), platform as a service (PaaS) and software as service (SaaS).

a.) **IaaS** providers such as AWS supply a virtual server[7] instance and storage, as well as application program interfaces (APIs) that let users migrate workloads to a virtual machine (VM). Users have an allocated storage capacity and start, stop, access and configure the VM and storage as desired. IaaS providers offer small, medium, large, extra-large, and memory- or compute-optimized instances, in addition to customized instances, for various workload needs.

b.) In the **PaaS** model, providers host development tools on their infrastructures. Users access those tools over the Internet using APIs, Web portals or gateway software. PaaS is used for general software development and many PaaS providers will host the software after it's developed.

c.) **SaaS** is a distribution model that delivers software applications over the Internet; these are often called Web services. Users can access SaaS applications and services from any location using a computer or mobile device that has Internet access.

1.3) AUCTION BASED METHOD

Auction mechanism [11] is one of the advantageous and beneficial methods than the other existing mechanisms and which do not depend upon the demand and supply. In order to overcome the disadvantages of the market based approach the auction based approach [11] is now being widely used in the pricing and the resource allocation. In this approach, there is no fixed price. The price for the resource varies based on the demand and the supply. Both the buyer and the seller are free to provide with their valuation and a agreement is made over the price determined for the resource. And this approach gains profit to both the buyer and the seller.

The auction technique [11] is mainly used to allocate the resource to the requesting user from a group of resource providers who provide
various resourcefor accessing various service provided by the clo ud environment. The user's send the request for the resource through bids and the resource provider sends their fixed price limit for the resource as an ask to the auctioneer. The user with the highest bid usually wins the auction. The auctioneer's main duty is the allocation and the management of the resources in the auction[11].

2) PROBLEM STATEMENT

The base paper works on the moodle virtual cluster[7]. Here the server looks for physical storage if there is a requirement. If the physical storage is not able to fulfil the requirement, it looks for virtual cluster for more space. This is the current system. The proposed system calls for fulfilment of more requirements with the advent of technology. If the requirement for space is more than the capabilities of the moodle virtual cluster, it looks for it on the cloud services.

- It looks for a cloud service which is able to fulfil the memory requirement of the extra load on the server.
- If a cloud is accepted for the extra load, it looks for the cheapest cloud among the many available.
- If a single cloud is not able to fulfil the case requirements it looks for a combination of clouds that has the least cost and enough memory space.

3) PROPOSED WORK

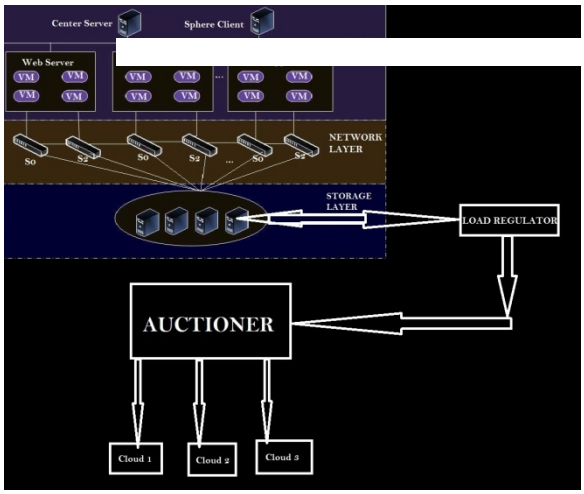


Diagram Explanation

1.) A Load Regulator is used to measure the load on the server.
2.) This process is repeated uniformly after a time frame.
3.) If the load on the server exceeds the threshold limit of the storage on the server the setup looks for space on the cloud.
4.) An auctioneer decides which cloud to be picked out of the many based on some strategies.
5.) If one of the clouds being the least cost, doesn't provide the extra space required by the server, the auctioneer looks for other clouds that fulfil the required needs.
6.) It may even select a group of clouds in such a way so that such a combination is developed that the space required is fulfilled exactly keeping the cost to its minimum.
7.) This strategy is known as combinatorial auction strategy which is being used in such a machine.

3.1) Combinatorial Auction

The combinatorial auction [11] is one the beneficial auction method available in the cloud environment for resource allocation. The main aim of this auction is that the buyer can buy a group of items rather than individual item as in fixed price auction [11]. As the auction is done over group of items it is profitable to both the buyer and the seller. It contributes greatly to improve the revenue generation and allocation efficiency

3.2) ALGORITHM

- WSL -> Load on the web server \ HOST LAYER
- DSL -> Load on the database server \ HOST LAYER
- OAL -> Rest of the load (via other applications) \ HOST LAYER
- LC -> Load Capacity of the physical storage \ PHYSICAL STORAGE LAYER

(Threshold Value for total load= LC)

- EL -> Extra load that is not satisfied by physical storage
- Cloud available space "CAS" :

Mapping function to get available space value of the selected cloud(SC)

- SC -> Selected cloud
- AuctionCost -> Method to find least cost cloud
- S1= {CCS1,CCS2,CCS3} -> Set of costs per GB of the clouds
- Allocate(arg) -> A function that allocates the selected cloud services to the server
- S2 = {} -> Initially an empty set used to make a set of clouds which alone cannot fulfill the server's extra load requirements.
- ConstructCloudPairs(arg) -> This function given a set of single clouds as input gives the set of all combinations of cloud pairs as the output.
- S3 = {S1-S2, S2-S3, ……} -> This set is used to store the cloud pairs output generated by the ConstructCloudPairs function.
- SCP -> Selected Cloud Pair
- CPAS -> A function used to calculate the available space from both the clouds in a pair.

- WAIT(DefinedTimeInterval) -> This function halts the process for a "defined time interval".

ALGORITHM FOR A SINGLE CLOUD OR A CLOUD PAIR SELECTION FOR EXTRA LOAD

BEGIN
1.) If WSL+DSL+OAL>LC : GOTO Step3;
2.) Regulate physical storage in accordance with WSL, DSL & OAL & GOTO Step11;
3.) AuctionCost(S1)= SC;
4.) If CAS(SC)<EL : GOTO Step6;
5.) Allocate(SC) & GOTO Step11;
6.) if (S1!=NULL): Remove(SC) from S1, Write to S2 & GOTO Step3;
7.) ConstructCloudPairs(S2)=S3;
8.) AuctionPairCost(S3)=SCP;
9.) If CPAS(SCP)<EL: GOTO Step11;
10.) Allocate(SCP) & GOTO Step11;
11.) WAIT(DefinedTimeInterval) & GOTO Step1;
END

AuctionCost()
BEGIN

```
1. int i,SC;
2. int a[2]={CC1,CC2,CC3};
3. SC=a[0];
4. for(i=0;i<=2;i++)
5. {
6. if (a[i]>SC){
7. SC = a[i];}
8. }
9. return SC;
```

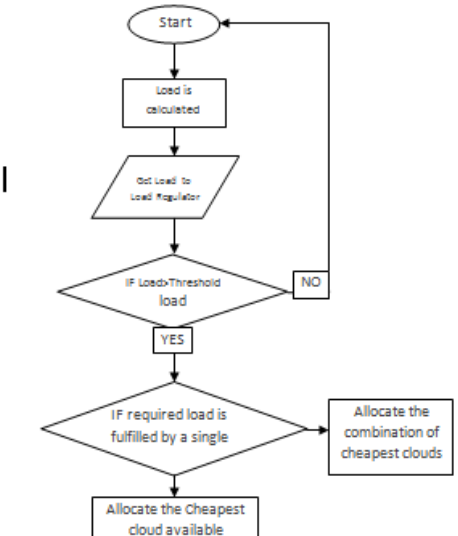
END

AuctionPairCost()
BEGIN

```
1. int i,SCP;
2. int a[2]={CC1CC2,CC1CC3,CC2CC3};
3. SCP=a[0];
4. for(i=0;i<=2;i++)
5. {
6. if (a[i]>SCP){
7. SCP = a[i];}
8. }
9. return SCP;
```

END

FLOWCHART



4) RESULTS AND SIMULATION

Here load test for the moodle is performed using Jmeter[12] and the results are displayed in the form graphs and tables.

JMETER is an open souce application which is purely java based designed to test load and measure performance. It was originally designed for testing Web Applications but has since expanded to other test functions [12].

Attributes of the Table results are shown below:

1) Number of samples
2) Start time
3) Thread name
4) Type of Request(Label)
5) Status
6) Bytes
7) Latency
8) Connect time
9) Deviation

- Here start time shows, starting time of the process.
- Sample time is nothing but the response time (= load time) (= elapse time) is a difference between the time when the request is sent and the time when the response is fully received.
- Response time is always greater than or equal to latency.
- Status is responsible for, whether the process is running correctly or not.
- Byte is the number of bytes transferred per second.
- Latency is the difference between time when the request is sent and the time when the response starts to receive.
- Connect time measures the time it took to establish the connection.
- Deviation is treated as error counter. Actually it gives information about number of http requests failed to complete smoothly.

Explanation of the **Response Time Graph** is as follows:
Response time graph shows the relationship between the "total response time" in milliseconds (y-axis) and the "number of http requests" (x-axis).

Test Results for 2GB memory:

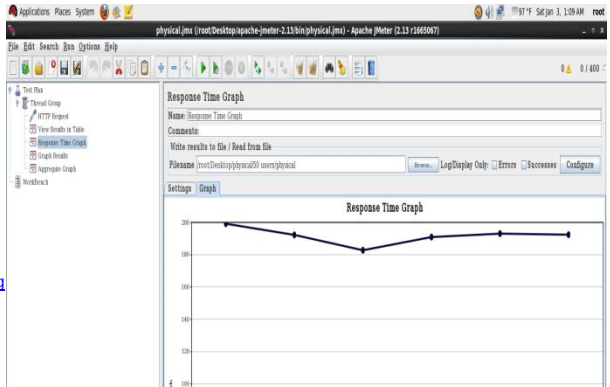


Fig 4.1 Response Time Graph for 400 samples

Here the response time graph for 400 samples shows constant response time which is in the range of 180-200ms.

Test Results for 4GB memory:

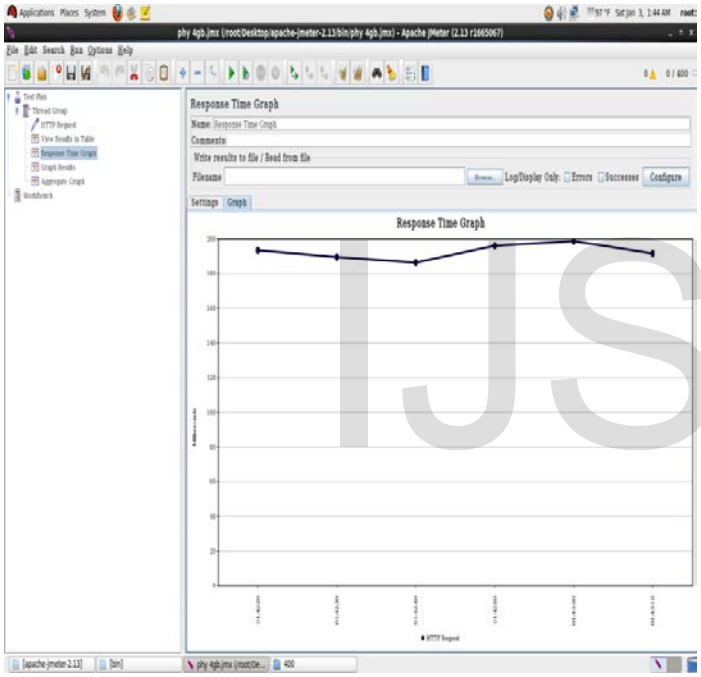


Fig 4.2 Response Time Graph for 400 samples

Here the response time graph for 400 samples shows constant response time which is in the range of 180-200ms.

2 GB RAM from Cloud 1 (Total 6 GB):

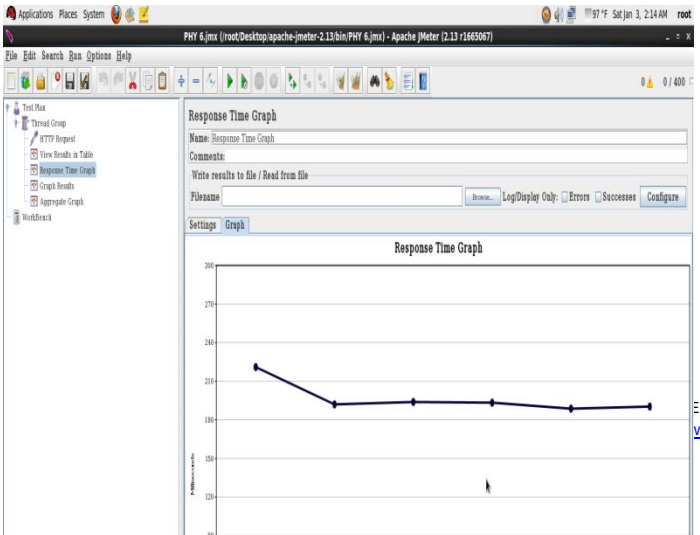


Fig 4.3 Response Time Graph for 400 samples

Here the response time graph for 400 samples shows constant response time which is in the range of 180-240ms.

2 GB RAM from Cloud 2 (Total 8 GB):

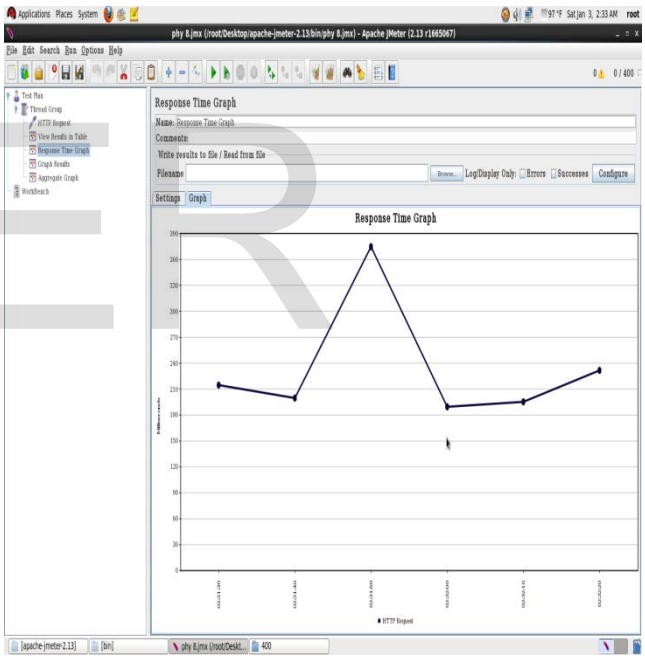


Fig 5.8 Response Time Graph for 400 samples

Here the response time graph for 400 samples shows constant response time which is in the range of 180-390ms.

5) CONCLUSION

The work carried out here is closely related to load balancing. In this work adaptive based auction method is used for load balancing for moodle server. Auction method assures reduced cost through memory extension. The load regulator used supports an adaptive approach.

In the future work research work are open by the following ways:

(1). Optimization of method will be useful to decrease memory requirement.

(2). Different methods of auction and adaption can be used .

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