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DOUBLE AUCTION PRICING SCHEME FOR EFFECTIVE UTILIZATION OF RESOURCES IN CLOUD

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Abstract - In Cloud computing, user and provider have different requirements. Pricing is a critical component in cloud computing. The pricing scheme is not appropriate to the demand services as there are changing requirements and other parameters like duration of contract. In existing system, Cloud provider provides the pricing scheme called concave pricing scheme. Concave pricing scheme provide an optimal cost for the customer. The cloud broker provides the resources with minimum cost. In Concave Pricing Scheme, cloud broker analyzes whether the resources are utilized and then calculate the cost based on job length. The concave pricing scheme provides an effective cost reduction for only customer but the scheme not benefited for the cloud provider. In proposed methodology, Double Auction Algorithm is a market based model used to submit the bid value from both side and winner is selected by using auction process. The result is compared and analyzed the Double Auction algorithm is provide the better result for both user and provider.

Key words - *Concave, Double Auction, bid*

I. INTRODUCTION

Cloud computing is an on-demand service in which resources, information, software and other devices are provided according to the client's specification. Cloud Computing hides the complexity and details of the underlying infrastructure from users and applications by providing graphical interface or Applications Programming Interface (API). Cloud consumers and Cloud providers are the two key roles in the cloud environment. Cloud consumers are the users who make use of the computing resources. Cloud providers are the ones who provide those resources to the users. Cloud Computing is the latest trend in the IT which leads to movement of data and computational processes to large data centres from desktop and portable PCs. Now, applications can be delivered as a service over the network which decreases overall cost. The main motive of Cloud Computing is better utilization of distributed resources to achieve higher throughput and solves problem of large scale computation. End-user based on his requirements access different services without actually knowing where the services are hosted and how services are being delivered. Cloud computing is energetically scalable, device independent and task-centric computing possessions are obtained ended the Internet, with any charges being on a per tradition origin.Cloud computing is used to provide services to improve the utilization of data centre resources which are operating in most dynamic workload environments. Data centres are the essential parts of cloud computing. In a single data centre, hundreds and thousands of virtual servers run at any instance of time. Virtualization as a key technology is broadly studied for handling distributed computation tasks in a flexible and powerful environment. It offers isolation and security mechanisms to operating systems, customizes and encapsulates entire application environments and supports legacy applications. The Cloud provider is responsible for managing the physical resources and making resources available for cloud consumers through a set of service interfaces and computing resource abstractions such as Virtual Machines and Virtual Network Interfaces. The Virtualization provides hardware independence, guest operating system and encapsulation of entire Virtual Machine grouped into a single file. Virtualization is implemented with hypervisor technology. Virtualization technique which converts the behaviour of the computer hardware to a software program. By Virtualizing, physical machine able to run several operating systems at the same time. Various Cloud providers have started using auction based pricing models for their Cloud resources. Auction model introduces more revenue for providers and cheaper prices for users. Prices vary according to increasing and decreasing demand like Amazon Spot Instances have been introduced by Amazon Web services for selling their unused capacity resources. As long as the customers' price is more than spot price, customer's instance is running. Spot price is set based

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on current utilization of data centres by Amazon (Amazon Web Services 2010).

II. RELATED WORK

Wang et al., [1] have proposed a fixed pricing method for pricing their resources and do not provide any incentive to their users. a user who wants to use a service in the form of an application hosted on a cloud. The cloud vendors are used to provide the quality-of-service parameters at different prices. The user has to select the appropriate one within the budget. This selection is complex and challenging one because the companies offering cloud services changes continually. Cloud broker has used to handle the agility of a process using cloud services. Cloud computing is a model for enabling resource allocation to dynamic business workloads. The performance degradation of networks affected the cloud application performance and user request. the reservation and resources utilization become critical issues which include data and network resources. the quality of service constraint dynamic resource selection algorithm has been implemented for optimization of resources allocation.

Van Den Bossche et al., [2] have stated that Resource Management Systems have to utilize additional resources from public. Cloud providers cannot cope with the demand of the applications. The Resource Management Systems has also determined which tasks will be executed on them and in which order will be submitted (scheduling). Dynamic provisioning of Cloud resources operate at a job level and ignoring characteristics of the whole organization workload, which leads to inefficient utilization of Cloud resources. Scheduling is able to complete applications cost-effectively within their deadlines and determine the cost of utilization of public cloud resources to be assigned to each user. When Cloud resources are deployed, users have to be made accountable for the extra cost incurred by such resources. This is required for reducing the operational costs of the organization.

Marian Mihailescu et al., [3] have described the different types of resources from one or more resource providers using a fixed pricing scheme. Federated clouds allow different cloud providers to share resources for increased scalability and reliability. Users and providers of cloud resources are rational and maximize their own interest when consuming and contributing shared resources. User may represent an individual user, a group, or an organization. In federated clouds, users request resources from different providers. In fixed pricing, where users have to use the resources from different providers, pricing scheme is designed to allocate a request for multiple resource types.

Mamatha et al., [4] have stated that the user can access the resources by paying the price for the usage. Cloud provider can offer two provisioning plans for computing resources namely reservation and on-demand plans. Reservation plan is cheaper than on demand plan but best advanced reservation is difficult to achieve due to uncertainty of user's future demand and provider's price. Demand and price uncertainty is considered in Optimal Cloud Resource Provisioning (OCRP) algorithm. The OCRP algorithm is used to provision the resources in multiple provisioning stages as well as long term plan. OCRP uses Stochastic programming model, Benders decomposition and Sample Average Approximation (SAA) to reduce total cost resource cost.

Henzinger et al., [5] have stated that Cloud broker promises virtually unlimited computational resources to its users while letting them pay only for the resources actually use. The user needs to decide how many Virtual Machines should rent to execute a given job. This does not only pose a high burden on the user but also leads to non-optimal utilization of the cloud. Once a user rents a Virtual Machine, the cloud cannot run other computation on that machine. Similarly, the existing pricing models are too rigid to foster good utilization. Flexible Provisioning of Resources in a Cloud Environment (Flex Price) is used. Instead of renting a set of specific resources, the user simply presents the job to be executed to the cloud.

III PROBLEM STATEMENT

Optimal Resource allocation is one of the biggest challenges in Cloud environment. Cloud providers have resources which should be efficiently allocated otherwise there could occur the problem of under utilization or over utilization. Moreover there are multiple providers in Cloud market space who want to sell resources. Each provider wants to sell resources to users and earns maximum revenue. In this scenario, it becomes difficult for users to choose the best among the Cloud providers. It is also challenging for providers to choose the user who values the resources more. So the problem is to determine an appropriate Cloud provider for each user who could sell various resources in minimum possible amount

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according to his requirements and find suitable customer for Cloud provider who values his resources at the most. Most of the techniques are biased towards provider. But none of the techniques favour provider and customer simultaneously in unregulated Cloud market. The model should satisfy all the requirements of users at a given point of time. It should also impose some minimum restrictions on the Cloud providers to fulfill requirements.

IV PROPOSED SYSTEM

The double auction algorithm is used to allocate the resources efficiently to the user and also provides benefits for the provider. Buyer asks resources and seller usually bid for providing services to users. The auction winner provides services to users. In this, multiple cloud resource providers and multiple users who want resources to complete their task. The users submit their requirements to the broker. There are different types of resources available with Cloud resource providers. User sends the resource request to the broker. User and provider send the bid value to the auctioneer. Auctioneer send messages to Cloud providers and user that bidding is started. Cloud provider can only bid if they have enough resources for bidding or if they have resources in overbooking. Overbooking means the cloud provider knows that completion of auction process, the resources will become free from some another user who is currently using resources. After bidding by providers, auctioneer will start mapping users and providers and calculating the lowest bid provider and highest resource demanding user. If lowest bid provider has enough resources that to be assigned to first user. Otherwise, check for next resource provider. Double auctions prevent providers from having monopolies and are suitable for cloud computing. However, providing a market-based resource allocation model that is economically efficient and considers equitable benefits for both users and providers.

ARCHITECTURE

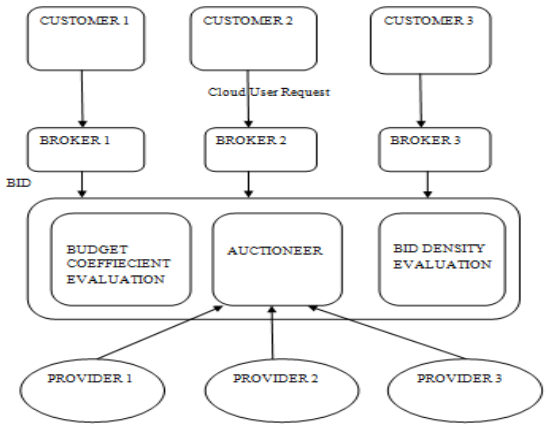

Figure 1 Architecture For resource allocation to the User using Double Auction algorithm.

In Double Auction algorithm, consist of four entities such as User, Broker, Cloud Provider and Cloud Market Place shown in Figure 1. Cloud Market Places contains Cloud Information Service (CIS) and an Auctioneer. The Double Auction resource allocation algorithm consists of multiple numbers of cloud providers and brokers. The broker acted as users in the Double Auction resource allocation algorithm to participate in the auction.

V DOUBLE AUCTION ALGORITHM

1) User

User uses the resources and fulfils the requirements by completing the task. User request the resources to the broker in which user mention number of resources required of each type, time for resource requirement and its budget. The users are assigned to a particular cloud resource provider by auction process. When requirements are fulfilled, user pay the amount for the resources.

2) Auctioneer

Auctioneer is the centre of the complete auction process. It is responsible for assigning particular resource provider to user. Auctioneer is responsible for determining auction winners and informing to the user.

3) Cloud Resource Provider

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Cloud provider contains a resource such as Memory, CPU, disk and storage space. Provider wants to sell these resources as to gain maximum revenue. Cloud provider will bid the value for the offered resources .If provider has enough resources it can participate and bid for resources. If it wins the auction, cloud provider provides the resource to the users and earns profit.

VI DOUBLE AUCTION PARAMETERS

- Let there be N number of users and n represents user number, $N = \{1,2,3.....n\}$.
- Consider M number of Cloud resource providers and m represents Cloud resource provider number. $M = \{1,2,3.....m\}$.
- Total number of resource types are K and $K = \{1,2,3.....k\}$.
- Each user asks for different amount of each resource type. And every Cloud provider has also different amount of each resource type.
- The user requirement vector can be represented as $An = \{ a1\ n\ ,a2\ n,a3\ n....ak\ n,tn,bn\ \}$ where tn represents the time for which user require resources on per hour basis and bn is the budget of the user.
- When Cloud resource provider will bid and advertise resources available represented by vector $Rm = \{r1m,r2m\ ,r3m....rkm\}$ and price for each resource type as $Pm = \{p1\ m, p2\ m,p3\ m....pk\ m\}$.
- Weight vector W of resources representing different weight for each resource can be represented as $W = \{w1, w2.....wk\}$.

Table.1 shows the complete list of parameters used in the algorithm model. In the table various parameters used in algorithm model for calculating auction winner and price calculation are described.

PARAMETER	DESCRIPTION
N	Number of users
n	User number
m	Provider Number
A	User requirement vector
P	Provider bid price vector
M	Number of Cloud Resource Providers
K	Total number of different resources
R	Quantities available with provider vector
t	Time for which user require resources
W	Weighted vector of resources

Table .1 List of Parameter

VII MODULES

1. Cloud Provider Configuration and Generating User Bundles

Input: Datacenter configuration input parameters, resources
Output: Created Cloud datacenter and assembled resources.

Initially the cloud datacenter is registering their resource details to the Cloud Information Service (CIS) in order to act as a seller in the cloud market place. The cloud user sends their requirements to the broker. Each cloud user have broker who is act as the auction participant on behalf of a users. The brokers will send the cloud user demands and bids to the auctioneer.

2. Bid Density Evaluation

Input: cloud user bids, provider bids
Output: Bid density values

After the cloud user request and cloud service provider offer received at the auctioneer, an auctioneer is responsible for whole control of an auction. The auctioneer used to estimate the bid density function for cloud service providers and cloud users. This density function is used for winner determination with respect to the budget coefficient.

3. Budget Coefficient Based Winner Determination

Input: budget coefficient, user bids, provider offers
Output: Winners in the round

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The cloud user remaining budget is considered for auction winner determination. The budget coefficient is calculated for every user according to the remaining budget. This remaining budget is added to the bid density function and average of the two values will decide the auction winner. The user with more budget coefficient will have chances to win the round of an auction. The cloud user average bid density is sorted in descending order and cloud provider bid density sorted in ascending order. The first user and first service provider in the list is taken for the resource matching. If the service providers have matched resources for the user request then the cloud provider allocate the resources for the user. If it is not matched, next service provider in the list is considered.

4. Resource Allocation

Input: Round winners
Output: Resource allocation schedule.

If the winning cloud users and cloud providers are determined, then corresponding cloud provider is selected for the requested user. The Virtual machine instance is created by the broker in the cloud datacenter. Then broker allocate the resource to the user. The user has to pay as mentioned in the charge for the VM packages.

5. Run Task

Input: Allocation Schedule
Output: Run tasks (Cloudlets)

The cloudlets (jobs or tasks) are submitted to broker who is act as the intermediate for user and service provider, then broker will send these tasks to the cloud datacenter. Finally the all tasks run over the selected datacenter virtual machines. The result is return to the cloud user and Virtual Machine is destroyed after the task completion.

VIII SIMULATION RESULTS

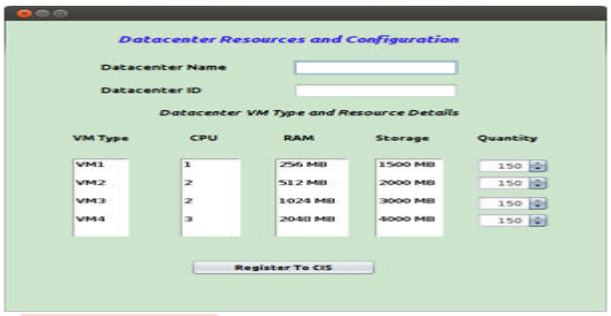

Figure 2 Register to Cloud Information System

Figure 2 represent Cloud Data Centre register to the cloud information system. The cloud data centre contains the resources such as CPU, Ram, Storage and Quantity.

All Cloud providers initially register themselves with the broker or auctioneer so that in near future they can send bid in auction is shown in figure 2.

Figure 3 represent the auction process to allocate the data centre to the user.

The Auction process is used to create a budget coefficient and bid density. The bid density is used to allocate the resources to the user is shown in figure 3.

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Figure 4 represent the creating a user bundle

The user budget is created and generating a bundle to fulfil the requirements is shown in figure 4.

Figure 5 represent creating a provider bundle.

The cloud provider bundle is created is shown in figure 5 based on offered resources. After generating bundle the bid density is calculated to the provider. The bid density is estimated to sort in ascending order to allocate the resources. After receiving bids from Cloud resource provider, auctioneer will calculate winners of the auction. Auctioneer will first calculate weighted total of resources requested by user. The users who require resources for more time will get higher value and the list will be sorted in descending order. Maximum value user will come at first place.

Bid density for Brokers

broker 1 ======> 0.25032513274340484
broker 2 ======> 0.20263829299326297
broker 3 ======> 0.30204825812301

Bid density for provider

datacenter1 ======> 0.014272742447250918
datacenter2 ======> 0.01885530323831401
datacenter3 ======> 0.013979832701086867

Budget Coefficient of Cloud Users

2====> 0.6439648977963109
3 ====> 0.9928766624980742
1 ====> 0.5730216155939015

Auction Winner

datacenter1 ======> user 3
datacenter2 ======> user 2

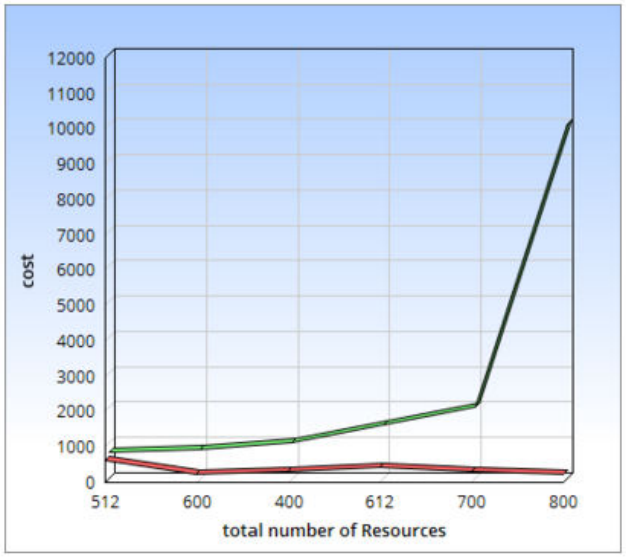

Figure 6 represent the comparison of concave pricing scheme and double auction algorithm.

The double auction algorithm is used to provide an optimal cost and maximize the revenue of provider. The total number resources are used by user and the cost is calculated.

IX CONCLUSION

Resource allocation is one of the most challenging issues in Cloud Computing. Cloud providers sell their resources through

fixed price model by direct selling which are not much efficient. A new auction based algorithm has been used. The algorithm efficiently allocates available resources of the Cloud provider and satisfies the requirements of users. The price has been calculated dynamically and the proposed algorithm is implemented in the Cloudsim. The results of the proposed algorithm show that the algorithm is beneficial for Cloud providers as they earn more revenue and Cloud users for optimally satisfying their requirements and allocates resources of Cloud providers.

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