

Price Adjustment for Double Auction Based Scheduling in Grid Environment

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Abstract— In Grid computing the resources are decentralized and dynamic in nature, managing the resources in such environment is a challenging task. Auction based scheduling is more attractive from the point of view of business. The market based negotiation techniques are used between the user and provider to optimize the user centric and provider centric objectives. This paper shows that Continuous Double Auction model is efficient and favour for both resource users and resource providers. Due to the impatient users the high price volatility will occur. To reduce unnecessary price growth, Compulsory Bidding Adjust Layer is used. It allows the prices to be in stable and also maintains the market equilibrium.

Index Terms— Resource Management, Double Auction, Scheduling, Market Model, Grid/Cloud computing.

I. INTRODUCTION

Computational grid it supports for the creation of virtual organizations it allows for sharing, selection and aggregation of distributed heterogeneous resources. The resource users can use the resources by running the grid portals and also the resource providers can share the resources by using the grid portals. The grid users can access the resources based on their requirements and demands and also based on the availability of the resources. Normally the grid environment is dynamic in nature at any moment the resource providers with various resources and services can add or removed from the grid, and also the resource user with various demands can enter into the grid.

The resources and end users are geographically distributed among different time zones [1]. The resources are dynamic and heterogeneous in nature, sharing and managing the resources in such an environment is a challenging task .In Grid environments both resource users and resource providers having different goals, objectives, strategies and policies .The user centric objectives are execution time and execution cost. The provider centric objectives are allocation

of resources, income and job throughput. Scheduler is responsible for allocating the resources among a group of resource users. When the multiple users competing for the same resource then scarcity of particular resource will occur and also it assumes the other users as competitors. Since the access for the resource is paid, it can be seen as a market governed by the supply-demand law. Economy-based negotiation techniques are attractive from the point of view of business .Both resource users and providers are tries to get the profit of their own. In an economy-based approach [2], during the run time the scheduling decisions will be taken based on the end user requirements. The economy model charges the end user based on their usage of services. The pricing policies is based on the demand of end-user and the supply of the resources. It creates the competitive environment. This is the reason the users competes with other users and the resource providers competes with other providers. The end users are not willing to pay the highest price so they negotiate on the price based on their need, priority and budget. Nowadays market based methods get more attention for grid resource management. The main two classification of grid resource management is commodity market model and auction model [8].

The commodity market model, in which the resource owner will fix the rate for the resources and charge the users according to the amount of resources they use. It is based on flat price model, once the price is fixed then it does not changed its price based on supply and demand, it remain fixed for a certain period of time. The resource owner is responsible for fixing and changing the price of the resources. The auction model is different from commodity market model, in which both the user and the resource provider will act separately and they agree on the selling price. In auction model it has no fixed value or price and it affected by a supply and demand law at any specific period of time. If the need of resource is low then they will decrease the price of the resource. If the demand is high then they will increase the price of the particular resource. The interaction between the user and resource provider takes place as a negotiation process it expressed in terms of service level agreement.

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II. RELATED WORKS

Auction model [3] is the powerful model for allocating the resources in the grid environment. Normally auction means it is a mechanism for allocating the resources among a group of bidders. Auctions can be conducted as open or closed form. The buyer will update the bid and the seller will update the offered price. Each auction has three different entities the seller, the buyer and the auctioneer. The auctioneer is responsible for the overall management of the auction. The auction models are classified into two main categories, single sided and double sided auction.

In single sided auctions [5], once the resources are submitted by the sellers then the buyers only submit their offers during the auction. The single sided auctions are English Auction, Dutch Auction, First price sealed Auction, Vickrey Auction.

In English Auction the seller will fix the price for the resource then buyers will constantly increase their bids, until the buyer with highest bid wins the auction.

In Dutch auction the seller will fix the highest price for the resource and continuously decrease the price until the buyer is ready to pay for the resource.

In First Price Sealed Auction the buyers submit their bids in the envelope without knowing the others bid, the buyer with the highest bid will win in the auction.

In Vickery Auction which is similar to the First Price Sealed Auction the buyers have no idea about the bid value of other bidders. The highest bidders win the auction and pay the amount which is equal to the second highest bid.

In Double Auction both the buyer and the seller will submit their offers which are known as bid and ask. The Double Auction [10] is classified into two main types, Call Auction and Continuous Double Auction.

In Continuous Double Auction (CDA) both the buyer and seller will submit their bid and ask continuously until the match between the ask and bid occur. The time spent for the computation is less. It requires lower level of communication. In Call Auction the auction has a predefined time frame when the participants submit their offer.

III. CONTINUOUS DOUBLE AUCTION MODEL

In continuous double auction model [9] both the buyer and sellers will submit their offers continuously until the match between the lowest ask and highest bid occur. When a match

between the lowest asks a_{\min} and the highest bid b_{\max} is achieved, the user who submits the highest bid will win the auction. The final price the user who wins the auction has to pay is $\frac{(a_{\min} + b_{\max})}{2}$, it is the final outcome of the auction.

The user who wins the auction will use the service for the specified time. The others participating in auction lose it. If the auction won by any user then the auction is also won by a particular resource provider. If the auction is cancelled then the resource provider loses the auction. When multiple users competing for the same resource then insufficiency of resources will occur. Both the user and the resource providers always try optimizing their own objectives so conflicts will occur. So negotiation process will take place in between the resource user and the resource providers.

The main actors of resource allocation process are users and the resource providers. The user submit their bids and the resource provider submit their asks to the central market (Auctioneer). In the central market the actual auction will take place. It is responsible for sending the results of the auction to the actors. The step by step which is performed in the continuous double auction model is as follows

- The resource provider creates the auction and initiates the auction with initial price
- User will continuously submit their bids and tries to win the resource during the auction.
- Then the resource provider submits their asks and increase the price of the resources.
- When the match between the highest ask and lowest bid occur, the user who submit the highest bid will win the auction.
- If no match is detected then the auction closed without the winner.
- The auctioneer sends the winning notifications to the winner and the resource provider.
- The auctioneer sends the loss notification to the other users who participated in the auction.
- The user who wins the auction will execute the service.

In continuous double auction model, once the match is detected then immediately allocates the resources to the user. The matching bid and the ask is deleted from the auction. And also the result is informed to the user and the provider by the auctioneer. If the auction failed then it will start the auction after a certain period of delay time interval.

The resources are priced based on their supply and demand. When the demand for the resource is high then they will increase the price, if the demand is less then they will decrease the price. The main objective of the user is to spend less money and the provider is to gain more profit. It can

check based on three different networks [7][6]. In CDA [4] it requires only the lesser amount of communication and it is favour for both resource users and the providers.

The participants in the market may apply different strategies to execute applications in a fast and cheap way based on the following elements:

- Resource selection which defines for which resource the schedulers should participate in auctions.
- Resource valuation which sets is the upper price limit considered for bidding.
- Auction participation which specifies when and for which tasks the schedulers participate in auctions.
- Bidding which determines how often and how high the participants bid given an auction and a resource valuation.

IV. PROPOSED SYSTEM

In proposed method, the Compulsory Bidding Adjustment Layer (CBAL) is used. In continuous double auction based scheduling, when matches between the lowest ask and highest bid occur it allocate the resources to the user. Due to this reason the impatient user will submit high price to win in the auction and make their transaction more quickly. So high price volatility will occur in CDA. It will cause the sudden price growth, changes in market equilibrium, and dissatisfaction will occur among the participants. To avoid this problem, the Compulsory Bidding Adjustment Layer (CBAL) will be used. It allows the resources to be in a stable prices. All the offers submit by the participants will send through this layer. If sudden price growth occur it will request for current market condition of CDA and generate the new value and allow it to participate in the auction. It reduce the price volatility.

The participants in the auctions are user and the provider. They submit bid and ask price. The step by step process of compulsory bidding adjustment layer is as follows.

- Users participate in an auction submits a message, offer (maxPrice), to indicate a willingness to buy the resource, where maxPrice is the maximum price that the user will submit. If the offer can be matched at the time of submitting, a contract will be passed back to the user. Otherwise, it is open in CBAL. The user can delete the offer as long as it has not been matched with a request.
- At the time of receiving an a message from a user, the CBAL will query the current status of the standard CDA.

- Upon receiving the current market status information, a new offer is generated using the price adjustment mechanism in the CBAL based on both the market information and the maxPrice. The new ask will then be sent to the standard CDA.
- Once a deal is made for the new bid in the standard CDA, the matching ask and bid will be removed and a contract will be generated. The corresponding provider and user will then be informed about the contract.

By using this CBAL, high price volatility occur in the CDA will be avoided. It also maintaining the market equilibrium, and make the price of the resources as stable state. It avoid the dissatisfaction among the users.

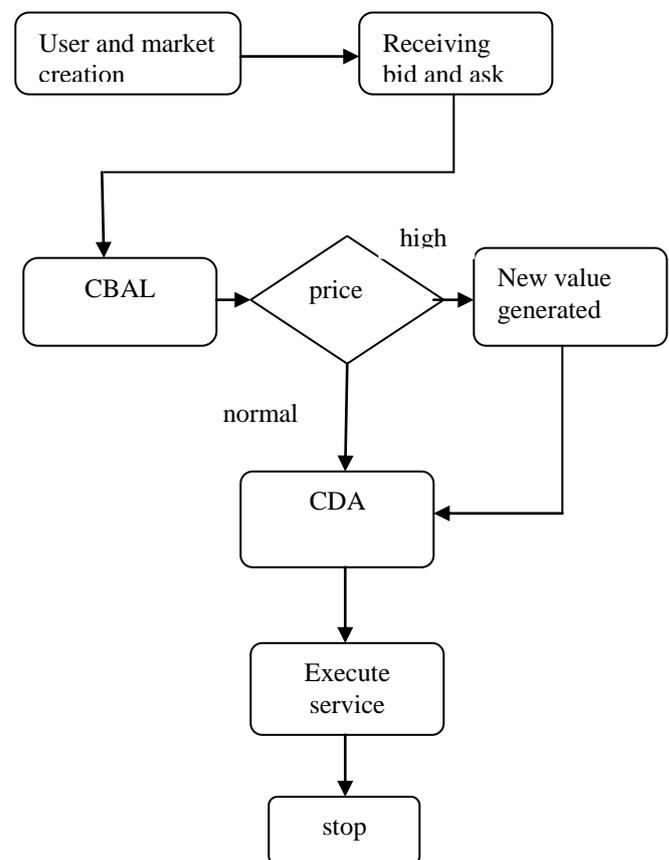


Fig 1: Flowchart for CBAL

When the bid is submitted by the user then it will pass through the layer of CBAL, if the price is too high then it does not allow to enter the standard CDA. It generate a new value based on the market condition and maximum bid submitted by user. Then CBAL pass the newly generated value to participate in CDA shown in Fig1. Then matches occur it allocate the resource to that user. The win user execute the service for a particular period of time.

V. RESULT ANALYSIS

The results are divided into two different parts. In the first part, we present the price growth occur in continuous double auction model. In the second part, we shows the price growth occur by using along with compulsory bidding adjustment layer. The simulation was performed using gridsim.

A. Continuous Double Auction

In CDA when the matches occur between lowest ask and highest bid, it allocate the resource to the user who submits the maximum bid. Due to this the impatient user will submit high price to win the auction. So sudden price growth will occur and also the market equilibrium will be disturbed. The Fig3 shows the sudden price growth occur in the market.

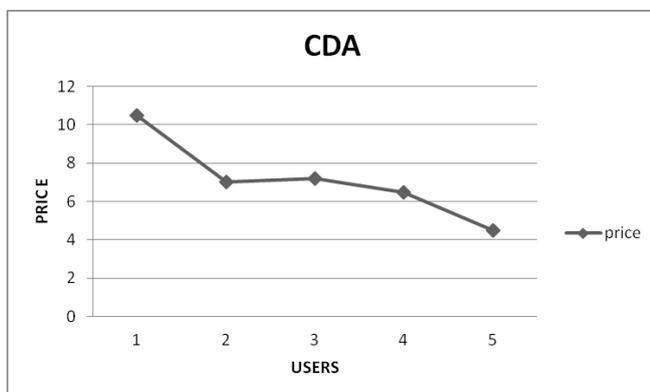


Fig. 2: Price growth occur in CDA

The fig2 shows due to the impatient user the price will suddenly raise upto 10. To overcome this limitation we introduce the concept of CBAL.

B. Compulsory Bidding Adjustment Layer

To avoid price growth occur in CDA, this price adjustment layer is used. It reduce the sudden price growth occur in CDA and allow the prices to be in stable. It maintains the market equilibrium in stable. It shows in fig4.

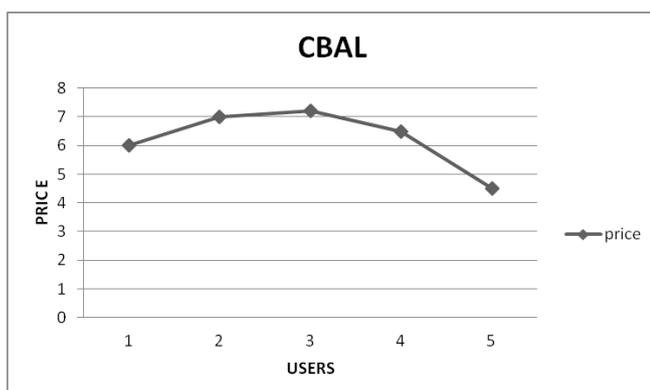


Fig. 4: Price growth reduction occur in CBAL

VI. CONCLUSION

The Continuous Double Auction model is favour for both resource users and the providers. It requires less computation time and the demand for communication is low. It is an efficient model for resource management in grid and cloud environment. But in CDA due to the impatient user the high price volatility will occur. It causes the dissatisfaction among the participants and also market equilibrium will be changed. To avoid this situation the compulsory bidding adjustment layer will be used. It reduce the sudden price growth and maintain the market equilibrium.

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