Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 8, August : 2024

AUCTION BASED RESOURCE ALLOCATION IN CLOUD ENVIRONMENT

Mr.B. SURESH REDDY[1], Mr.K.NAVEEN[2]

#1 Assistant. Professor in the department of CSE at QIS College of Engineering & Technology (Autonomous), Vengamukkapalem(V), Ongole, Prakasamdist.

#2 MCA student in the Master of Computer Applications (MCA)at QIS College of Engineering&Technology(Autonomous),Vengamukkapalem(V),Ongole,Prakasamdit.

ABSTRACT

The growing market of cloud computing resulted in increased demand for cloud resources and it will become difficult for Individual service providers (sps) to fulfill all resource requests. That leads to a situation where two or more sps may form a group (federation) and share the resources in order to fulfill the cloud users' demand and gain economic advantage. Now, due to the Formation of more than one federations by different cloud providers, it may be difficult for users to select a suitable federation who can Deliver cloud services at a fair price. In this context, it is necessary to have a framework that will efficiently allocate resources of cloud Federations to the users at a fair price and stop market manipulation. In this paper, we propose a multi-unit double auction mechanism Called TARA (Truthful Double Auction for Resource Allocation) that can be used to efficiently choose cloud federations for users from Which they can get resources. Here, we consider a multi-seller and multi-buyer double auction mechanism for heterogeneous Resources, where every buyer submits their bids and every seller places their ask (the price of a resource that is offered by a Federation). TARA achieves some important properties like truthfulness (also known as incentive compatibility), individual rationality And budget balance for both buyers and sellers. TARA is also computationally efficient and posses high system efficiency. The Simulation results also show that total utility of buyer is more than some existing double auction mechanisms.

INTRODUCTION

Group of service providers (sps) collaborate to share their computing resources with peers to gain some benefits in terms of profit and Quality of Service (qos) [1] [2] [3]. Cloud federation enables sps to handle unprecedented resource (virtual machine) demands without having to build new points-of-presence and eventually able to maintain committed qos in terms of scalability and availability. It also enables sps to make some extra revenue by sharing their idle or underutilized computing resources with peers during the time of low resource demand. Additionally, a federation also make it possible for overloaded sps to distribute their load among other member sps of that federation. Previously in [2] [3] [4], we have focused on the problem of cloud federation formation. But, in this work we have addressed the problem of resource allocation in federated cloud environment.

In cloud federation number of service providers collaborate together to avail the benefits provided by the federation. Now, let us consider the scenario, when there are more than one federations having different pricing models in the federated cloud environment, it may be difficult for users to select a suitable federation who can deliver cloud services at a fair price [5]. Hence, we should have a fair resource allocation mechanism that will efficiently allocate resources of cloud federations for users' resource requests without any market manipulation. Intuitively, we can say that resources should be allocated to those users who value them the most. In economics, auction theory [6] is a well researched field and has been applied to other domains. One of the important applications of auction theory is: it can be used as a method for efficiently allocate resources to those users who value them the most and to stop market manipulation. Hence, in this paper an auction mechanism is used to solve the problem of resource allocation in federated cloud environment. We propose a multi-unit double auction called TARA (Truthful Double Auction for Resource Allocation) that can be used to efficiently choose cloud federations for users from which they can get resources.

Please note, we have preferred to use double auction over a single sided auction. This is because, a single side auction can either be sell-side or the buy-side. In a sell-side auction commodities are distributed from a single seller to more than one buyer. On the other hand, in a buy-side auction, a buyer receives asks (offer prices from sellers) from more than one seller and selects a winner from whom the buyer will buy the commodity [7]. What if we have more than one seller and also more than one buyer? Well, we just merge together a buy-side and a sell-side auction to develop a two-sided auction mechanism which is also known as a double auction. In other words, double auction is an auction in which both buyers and sellers are involved actively. Our scenario perfectly matches with a double auction. It is because we have more than one seller (cloud federation) and more than one buyer (cloud user). Hence, double auction provides the platform to both the cloud federations and the cloud users such that, they can involve in trade simultaneously. In this paper, the terms sellers and buyers are used interchangeably with the terms cloud federations and cloud users respectively.

Auction can be used to efficiently allocate resources of sellers to buyers in a market. Here we consider a market of cloud federations' resource allocation, in which cloud federations offer resources to cloud users. In this paper, we model the cloud resource allocation as a double auction, where our auction mechanism finds a mapping between a set of cloud federations and the users. If a federation is mapped to a user then it means that the federation can deliver services to that user. The double auction model proposed in this paper is a multi-unit double auction for heterogeneous resources.

However, designing an auction mechanism for allocating resources of cloud federations to the users is expected to hold certain properties, such as:

Truthfulness: A given auction mechanism will be truthful if disclosing the private valuation truthfully is always the dominant strategy for sellers and buyers participating in the auction to get an optimal utility, no matter what strategies other participants (buyers and sellers) are using.

Computational efficiency: The computational efficiency property of an auction says that the auction outcome (allocation of resources and calculation of clearing price and payment be computed in polynomial time.

Budget balance: Budget balance says that all monetary transfers must be done between cloud users and the cloud federations, and the auctioneer or broker (a trust worthy third party who supervise the auction) should not lose or gain

Literature survey

In [10], Rochwerger et al. present the primary requirements for forming federations among cloud SPs. In order to support these requirements Rochwerger et al. in [11] introducing the Reservoir model whose main aim is to find the technology required to overcome the problem of scalability faced by any individual service providers. Further, they have introduce the model in which more than one SPs collaborate together to provide services as a federated cloud. Goiri et al. [12] modelled cloud federation as a means for a SP to dynamically increased their computing capacity by collaborating with other SPs when demands are high and rent out unused computing resources to other SPs when the demands are low. They introduced several equations to help SPs to decide when to outsource resources to extraneous SPs, insource (rent out) free resources to other SPs and shut down unused physical machines to save power. Celesti et al. [13] presents a system named Cross-Cloud Federation Manager which allows a SPs to form a federation with other SPs based on three phase model consisting of discovery, match-making and authentication. Their model considers home cloud and foreign cloud. Where home clouds, when fall short of computing resource capacity and unable to fulfill users' requests, outsource the requests to the foreign clouds. In [1], Mashayekhy et al. formulated cloud federation formation based on hedonic coalitional game. The main objective of their work is to maximize the profit of the formed federation. Moreover, Wahab et al [17] have also provided the solution for cloud federation formation based on Hedonic coalitional game. But the main objective of their work is to minimize the malicious- ness between service providers within federation.

In [14], Kumar et al provide a systematic and detailed study of double auction techniques for cloud market. Kumar et al [15] also design a combinatorial double auction called TCMDAC for cloud market. In [16], Farajian et al propose a market-driven continuous double auction method (MCDA) for efficient cloud service allocation. Two widely known double auction mechanisms in economics literature are, Vickrey-Clarke-Groves (VCG) [18] [19] [20] and McAfee [8] double auction mechanism. The VCG double auction mechanism can satisfy truthfulness property [9]. Also, it can be shown that VCG double auction can achieve individual rationality property [21]. The other double auction mechanism, McAfee can achieve three desired properties- individual rationality, budget balance, and incentive compatibility (truthfulness).

EXISTING SYSTEM

Cloud federation has emerged as a new paradigm in which a group of service providers (SPs) collaborate to share their computing resources with peers to gain some benefits in terms of profit and Quality of Service (QoS). Cloud federation enables SPs to handle unprecedented resource (virtual machine) demands without having to build new points-of-presence and eventually able to maintain committed QoS in terms of scalability and availability. It also enables SPs to make some extra revenue by sharing their idle or underutilized computing resources with peers during the time of low resource demand. Additionally, a federation also make it possible for overloaded SPs to distribute their load among other member SPs of that federation. Previously we have focused on the problem of cloud federation formation. But, in this work we have addressed the problem of resource allocation in federated cloud environment.

Draw back in Existing System

The cloud service providers within a cloud federation cooperate in order to provide the computing resources, requested by the cloud users. Let us consider the scenario, where cloud resources like virtual machine are offered through the cloud federations to the cloud users. Here, we assume every cloud federation provides their resources to the cloud users in the form of some instance types such as Large (L) instance, Medium (M) instance, and Small(S) instance. The instance types comprise varying combinations of CPU, memory, storage, and networking capacity. The resources of the same type from different cloud federations may have different preferences to the cloud users depending on the factors like Quality of Service (QoS), Prices etc. A set of cloud users (buyers), a set of cloud federations (sellers) and an auctioneer are involved in the auction. The auction process is completely governed by the auctioneer. Here, auctioneer act as trusted third party between buyers and sellers. The cloud users place their bids to the auctioneer for the resources based on the preferences given to the cloud federations. On the other hand, the cloud federations place their asks to the auctioneer. The federations and the users submit their needs and bids to the auctioneer in such a way that no participant in the auction knows the asks/bids of any other participants. Now, from the submitted bids and asks, an auctioneer finds a mapping between the cloud federations and the cloud users. The auctioneer also decides the clearing price (hammer price) and the payment. A cloud federation can deliver services to a cloud user if and only if the auctioneer finds a mapping between that cloud federation and the user.

Proposed System

Here, in our proposed double auction mechanism TARA, cloud users and cloud federations place their bids and asks to an auctioneer which is an trust worthy third party. The auctioneer manages and controls the auction process, like deciding the Allocation of resources and determining the clearing price (also known as hammer price) and payment. Here, clearing price is the price charged to a buyer for using resources of the sellers and payment is the price given to the seller for providing the service. TARA works as follows: The auctioneer gathers asks and bids from the cloud federations and the cloud users respectively. Then, the auctioneer finds a mapping between those asks and bids by allocating auction commodities from the cloud federations to the cloud users, as well as payments from the cloud users to the cloud federations accordingly. The key contributions of this work are as follows:

We model the resource allocation problem of cloud federation as a double auction.

TARA provides an auction mechanism which is proved to be truthful, individually rational and budget balanced.

The simulation results shows that, TARA achieves high system efficiency compared to some of the existing double auction mechanisms.

Advantages

- The proposed is implemented TRUTHFUL DOUBLE AUCTION BASED RESOURCES ALLOCATION MECHANISM which is more effective.
- In the proposed system, the system proposes a multi-unit double auction mechanism called TARA (Truthful Double Auction for Resource Allocation) that can be used to efficiently choose cloud federations for users from which they can get resources.

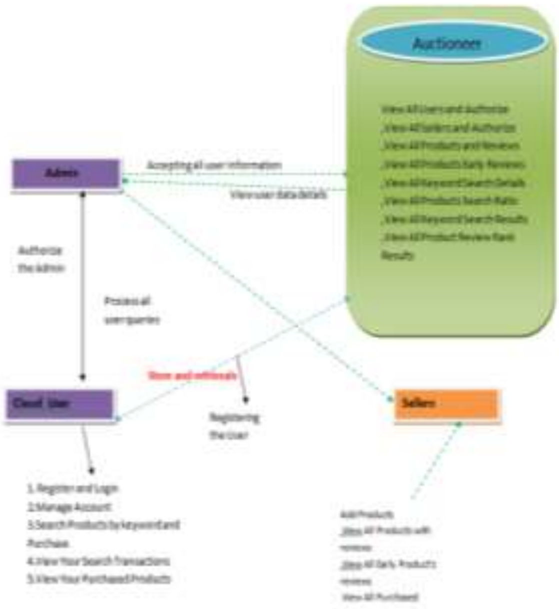

Fig Architecture Diagram

IMPLEMENTATION

Auctioneer

Auctioneer authentication in this section requires a user name and password. After a successful login, he will be able to do certain actions. Browse Users and Grant Permissions, Peruse Any Online Store and Give Permission, Have a look at the Full List of Products and Ratings, Browse All Products Samples, See the Complete List of Keyword Searches, Look at Every Product's Rating on a Search Engine, See Every Search Result for Every Keyword, Read Every Product Review Results Ordering

View and Authorize Users

An overview of all registered users is available to the administrator here. Here, the administrator may see the individual's credentials and provide access to them, including their name, email, and physical address.

Results in a Graph

All Product Search Ratio, Keyword Search Results, Product Review Seller Rank

Sellers

Exactly n individuals are currently logged into this module. In order to do any actions, the user must first register. Users' information will be saved in the database after they sign up. After his registration has been approved, he will be able to access the site using his unique login details. Once logged in, the user will do actions such as "Add Products" and "View Cart."Browse All Products that have Ratings,See All Reviews on Pre-Release Products, and Check Out All Purchases.

Cloud User

Exactly n individuals are currently logged into this module. In order to do any actions, the user must first register. Users' information will be saved in the database after they sign up. After his registration has been approved, he will be able to access the site using his unique login details. After a successful login, the user may do actions including managing their account and purchasing products using a keyword search and filtered results. Take a look at your recent purchases and search history.

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 8, August : 2024

CONCLUSION

In this paper, we focus on a truthful double auction for resource allocation which map the resour

ces of winning federations to the winning cloud users. TARA can effectively allocate the cloud federations resources among the users to satisfy their demands, while maintaining the desirable properties (computational efficiency, individual rationality, budget balance, and truthfulness) for both buyers and sellers. We have provided rigorous proof on these properties of TARA and confirmed the analysis with extensive simulation results.

REFERENCES

[1] L. Mashayekhy, M. M. Nejad, and D. Grosu, "Cloud federations in the sky: Formation game and mechanism, IEEE Transactions on Cloud Computing, Vol. 3, no. 1, pp. 14-27, 2015.

[2] B. K. Ray, A. Saha, S. Khatua and S. Roy, "Quality andm Profit Assured Trusted Cloud Federation Formation: Game Theory Based Approach," in IEEE Transactions on Services Computing.doi: 10.1109/TSC.2018.2833854

[3] B. K. Ray, A. Saha, and S. Roy, "Migration cost and profit oriented cloud Federation formation: hedonic coalition game based approach". Cluster Computing, 21(4), pp.1981-1999, 2018.

[4] B. K. Ray, A. Saha, S. Khatua and S. Roy, "Toward maximization of profit And quality of cloud federation: solution to cloud federation formation Problem," The Journal of Supercomputing, pp.1-45, 2018.

[5] B. K. Ray, A. I. Middya, S. Roy and S. Khatua, "Multi-criteria based Federation selection in cloud," 2017 9th International Conference on Communication Systems and Networks (COMSNETS), Bengaluru, 2017, Pp. 182-189.

[6] V. Krishna, Auction Theory, 2nd ed. Academic Press, Aug. 2009.

[7] S. Parsons, J. A. Rodriguez-aguilar, M Klein, "Auctions and Bidding: A Guide for Computer Scientists", ACM-TRANSACTION January 10, 2011 14:36

[8] R. P. Mcafee, "A dominant strategy double auction," Journal of Economic Theory, vol. 56, pp. 434-450, Apr. 1992.

[9] D. Parkes, J. Kalagnanam, and M. Eso, "Achieving budget-balance with Vickrey-based payment schemes in exchanges," in Proc. International Joint Conference on Artificial Intelligence, 2001, pp. 1161-1168.

[10] B. Rochwerger, D. Breitgand, E. Levy, A. Galis, K. Nagin, I. M. Llorente, R. Montero, Y. Wolfsthal, E. Elmroth, J. Cceres, M. Ben- Yehuda, W. Emmerich, F. Galan, "The reservoir model and architecture for open Federated cloud

computing, IBM J. Res. Dev., vol. 53, no. 4, pp. 4:1-4:11, 2009.

[11] B. Rochwerger, D. Breitgand, A. Epstein, D. Hadas, I. Loy, K. Nagin, J. Tordsson, C. Ragusa, M. Villari, S. Clayman, E. Levy, A. Maraschini, P. Massonet, H. Muoz, and G. Tofetti, “Reservoir-when one cloud is not Enough, Computer, vol. 44, no. 3, pp. 44-51, Mar. 2011.

[12] I. Goiri, J. Guitart, and J. Torres, “Characterizing cloud federation for Enhancing providers profit, in Cloud Computing (CLOUD), 2010 IEEE 3rd International Conference on. IEEE, 2010, pp. 123-130.

[13] A. Celesti, F. Tusa, M. Villari, and A. Puliafito, “How to enhance cloud Architectures to enable cross-federation, in Proc. 3rd IEEE Int. Conf. Cloud Comput., 2010, pp. 337-345.

[14] D. Kumar, G. Baranwal, Z. Raza, and D. P. Vidyarthi, “A systematic study Of double auction mechanisms in cloud computing,” Journal of Systems And Software, 2017, pp.234-255.

[15] D. Kumar, G. Baranwal, Z. Raza, and D. P. Vidyarthi, “A truthful Combinatorial double auction-based marketplace mechanism for cloud Computing,” Journal of Systems and Software, 2018, pp.91-108.

[16] N. Farajian, and K. Zamanifar, “Market-Driven Continuous Double Auction Method for Service Allocation in Cloud Computing,” In International Conference on Advances in Computing, Communication and Control, Springer, 2013, pp. 14-24.

[17] O. Abdul Wahab; J. Bentahar; H. Otrok; A. Mourad, “Towards Trustworthy Multi-Cloud Services Communities: A Trust-based Hedonic Coalitional Game, in IEEE Transactions on Services Computing , vol.PP, no.99, Pp.1-1, 2016.

[18] W. Vickrey, “Counterspeculation, auctions, and competitive sealed tenders,” The Journal of Finance, vol. 16, pp. 8-37, 1961.

[19] E. H. Clarke. Multipart pricing of public goods. Public Choice, 11:17-33, 1971.

[20] T. Groves. Incentives in teams. Econometrica, 41(4):617-631, July 1973.

[21] D. Yang, X. Fang, and G. Xue, “Truthful auction for cooperative Communications,” 2011.

[22] Amazon EC2 Pricing, (2016), [Online], Available:
Http://aws.amazon.com/ec2/pricing/

[23] A. Jin, W. Song, and W. Zhuang, “Auction-Based Resource Allocation For Sharing Cloudlets in Mobile Cloud Computing”, IEEE Transactions On Emerging Topics in Computing,2015.

[24] cloudharmony Service Status of different cloud service providers. [Online]. Available: https://cloudharmony.com/status-group-by-regions

AUTHOR PROFILE:

Mr.B. SURESH REDDY Completed his M. Tech (Masters of Technology) in Arjun College of Technology & Sciences. At JNTU Hyderabad.Assistant professor in the department of CSE at QIS College of Technology(Autonomous),Vengamukkapalem(V), Ongole, Prakasam dist. His areas of interest are Data Structures, Machine learning, Java, and Web technologies.

Mr. K.NAVEEN, as MCA student in the department of MCA at QIS College of Technology (Autonomous), Vengamukkapalem(V), Ongole, Prakasamdist. he has completed BSC (Bachlor of computers science) in SRI SARADA Degree College From ANU UNIVERSITY. Her areas of interests are