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Bond Agent Based Resource Discovery & Allocation In Cloud Computing

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Abstract:
Cloud computing is a model that provides everything as a service. There are challenges in adopting cloud computing; one of the main issues is the resource allocation and scheduling. Finding a suitable resource for every client request in any distributed environment is a challenging task. Resource discovery is more complicated in cloud computing due to its characteristics like elasticity, scalability. In such a distributed environment, discovery and allocation of suitable resources for client requests place a vital role. In this paper, we present an Agent-based resource discovery and allocation algorithm considering response time, energy efficiency factor, load balancing, and proper resource utilization. This is the extension of our previous works and We compare the results of the framework with the previous job scheduling algorithm implemented in the cloud environment. Simulation results show that the proposed framework performs better than the existing algorithm and achieves the objectives.

Keywords- allocation, binding, energy efficiency, resource discovery, response time

I. INTRODUCTION

Our motive of research focus is on resource management in cloud. Resource management is the most challenging task in cloud computing. Managing distributed resources causes some problems: problem of resource information management, no standard definition of resource requirements, and difficulty of guaranteeing compatibility of resource allocation [1]. Resource management further divides in to two broad areas like resource allocation and scheduling. Resource allocation has five stages, i.e. resource discovery, filtering, verification, decision making, job submission. For a successful resource allocation, an accurate resource discovery places an important role. However, it's tough to produce excellent resources from varied organizations as a result of management policies and descriptions regarding varied resources square measure completely different in every organization. These variations cause a hitch about providing a uniformed view from various resources. User's requests are information of resource omponents which users want to use, such as CPUs, memory sizes, network bandwidth, or IP numbers, and a Degree of Similarity (DS) as a reference value to be used in comparing resources with user's requirements and to choose proper resources which are closely related user's requirements [1]. The remainder of the paper is organized as follows. Section II explores couple of various resource discoveries, allocation and scheduling algorithms with respect to energy efficiency, load balancing and the problem statement in detail; section III gives the detailed methodology and description which is used to solve the problem focused in this paper; section IV discusses the experiment setup and the evaluation results and section V concludes this paper with the future directions for further research.

II. RELATED STUDY

A. Resource Discovery

Qinzheng Kong et al [2] proposed a general resource discovery system for open distributed processing. It uses the DSTC architecture model to specify a resource discovery with the basic objects of objects, bindings, interfaces. It is one of the pioneering work for resource discovery in the field of distributed processing. Castano et al [3] proposed a semantic approach. The proposed H-MATCH algorithm is able to discover the location of compatible resources with respect to a target request, also in heterogeneous environments with a lack of agreement on resource descriptions. Rajiv Ranjan et al [4] presented a decentralized resource discovery system in Grid which utilizes a Distributed Hash Table (DHT) routing substrate for delegation of d-dimensional service messages with various parameters. Yulan at el [5] presents a hierarchical RD method to make use of attractive features of lumped and exhaustive methods. It proposes 3 layers of resource organizational model with the parameters of extensibility and performance. Ranjan et al [6] present a tutorial about P2P based RD in the global grid. It explore a range of decentralized RD techniques primarily motivated by the P2P network model. Also, it provides a complete state of the art, resource taxonomy, existing works on RD in grids. Mohammed at el [7] reviews the state of the art of RD techniques in a grid environment. It separates the RD into 4 categories, i.e., centralized, hierarchical, P2P, agent-based. And finally, the HPPGrid model is proposed. Mahamat at el[8] proposed scalable decentralized grid RD framework by integrating agents. Dong et al[9] propose a novel hierarchical P2P based grid model based on the existing grid resource discovery models. Leyli at el[10] use a weighted tree structure for resource discovery in which the edges have weight. It uses only one bitmap for the identification of available resources in nodes and also the resources of children and their descended nodes. Stelios at el [11] explored decentralized distributed search protocols that transform nodes of huge size distributed systems to act as both clients and servers and proposed an architecture that suggests nodes orchestration supported previous resource requests also as we model a service meta-registry for inter-cloud systems to store relevant information to service submission. Sarhadi at el [12] proposed a dynamic structure of GIS-based on peer-to-peer model using learning automata supported the parameters success rate, average number of hops/requirements, average execution time. Chung et al [13] proposed a direction-aware strategy which will alleviate the network traffic among unstructured information systems for distributed resource discovery service. Praveen at el [14] proposed a Distributed Cloud Architecture for efficient resource discovery. Mollamotalebi at el[15] focuses on the resource discovery approaches utilized in grid computing environments along side their behaviors in several conditions. Barati et al [16][17] studies the matter of after the failure of a resource during a chain of resources made for a selected task during a grid environment, discovering and finding a replacement resource that reconstructs the chain, and that they define a replacement agent that's called task agent, and by proposing an algorithm for increasing the fault tolerance against the probable failure of a resource within the resource chain. This work considers the resources of CPU, memory, disk capacity, network bandwidth, devices, software, etc. Zargar [18] at el introduced for the resource discovery with implications for searching efficient resources using symbolic logic and taboo table. K.M.Sim [21] proposed an agent-based model, a gossip-based resource discovery algorithm, a reasoning technique, and a bargaining mechanism for cloud resources. Boukadi [22] at el proposed a

Focused Crawler for Cloud service Discovery (FC4DC). Its service-oriented architecture ensures a neater modification for rapid updating and better performance. Furthermore, the proposed crawler guarantees saving the search time and better exploitation of the provider offerings because of a fanatical Cloud service description ontology. Frederic

[23] at el surveyed the state of the art of cloud resource management for IaaS. It's a summary of the recent research findings and technologies while that specialize in the resource management techniques. Santos [24] at el formulates the matter of resource allocation within

the Cloud of Sensors and propose Zeus, a hybrid (partly-decentralized) algorithm for solving it.. Yan Sun [25] at el focuses on resource allocation in fog computing and proposed a fog computing structure and present a crowd-funding algorithm to integrate spare resources within the network. Faiez [26] at el focuses on heterogeneity, interoperability, integration, and portability issues in cloud computing and proposed Open Cloud Computing Interface (OCCI) as a community-based and open recommendation standard for managing any quite cloud resources. It also proposed the OCCIware approach, to style, validate, generate, implement, deploy, execute, and supervise everything as a service with OCCI. Zarrin at el [27] provides an investigation on the present state of resource discovery protocols, mechanisms, and platforms for large-scale distributed environments, that specialize in the planning aspects. And also provide an overall guideline to style novel discovery approaches for distributed systems.

None of the previous studies and works investigates the resource discovery in terms of binding and independent message passing with Agent technology. In this paper, we propose a BOND agent- based resource discovery mechanism for cloud computing.

B. Energy Efficient Resource Allocation

From the economic point of view, cloud computing may be a new computing model which decided by economic principles. the essential philosophy of the work scheduling algorithm supported economic models is to determine market mechanisms between resource providers and resource consumers. It uses a price lever to regulate user needs and resource distribution. The research on the way to apply theory to resource distribution of distributed systems is often traced back to an auction mechanism for resource allocation within the PDP-1 machine, which proposed by Sutherland in 1968 [34]. In Ref [34], an auction method is described for allocating computer time that permits the worth of computer time to fluctuate with the demand and therefore the relative priority of users to be controlled in order that more important projects recover access. The auction method is predicated on reserving computer time. The main limitation of this type of method is it's numerous rules to order the pc time and therefore the limited availability. Most of the next research focused on solving the load balancing of a distributed system with the help of the worth mechanism [35]. In Ref [35], the target was to endow processors during a distributed system with resources and behavior almost like that enjoyed by actual consumers then allow an economic model to allocate resources between them within the manner of a traditional market. the most limitations of [35] where it’s mainly supported an assumption about the market and therefore the completion time and throughput parameters should be taken into the account. Along side the grid development, the researchers on the way to apply the market mechanism to grid resource allocation have also administered in-depth [36,37,38,39,40 and 41]. Among them, Popcorn [32] and therefore the Nimrod/G [33] are more influential. all of them reveal the validity of grid resource allocation supported the economics method. Ref. [42] has introduced a market-oriented cloud. it's one among the primary papers within the area. However, most of those studies didn't involve the fairness of resource allocation under the market mechanism. Hence the Berger model of distributed justice was implemented to supply better resource allocation within the cloud environment. It focuses only on fairness resource allocation; it's not that specializes in the energy efficiency factor. The scheduling algorithm was implemented using the cloudsim [43] package extended version and compared with the optimal completion time algorithm. This algorithm provides better completion while comparing it with the optimal completion time algorithm. Cloud infrastructures have recently become the middle of attention. They will support dynamic operational infrastructures adapted to the wants of distributed applications[44]. Moving to the energy efficiency parameter, the varied research works were administered from the last decays. In ref [45], a hybrid energy-efficient scheduling approach for personal clouds was proposed. during this approach, Jiandun Li et al provides an approach that's supported pre-power technique and least-load-first algorithm. This approach can save longer for users, conserve more energy and may achieve a better level of load balancing. But this approach is especially used for the daily use of personal clouds, not for public clouds. Jiandun Li extends his work [45] with the utilization of dynamic migration; proposed an energy-efficient

scheduling algorithm for personal clouds [46] to avoid the restrictions of the previous work which incorporates 1.Intrusion isn't accepted. 2. Workflow attributes regularly change cyclically. 3. Conserving energy, whereas keeping reaction time too long is beyond consideration. 4. Scheduling algorithms should be light-weighted. 5. Further optimization or consolidation (e.g. migration) should be carefully applied. This paper uses an easy algorithm without using any priority considerations. the utilization of computing in general and IT applications is popular now. Cloud computing promises to deliver such a computing infrastructure using data centers in order that HPC users can access applications and data from a Cloud anywhere within the world on demand and pay supported what they use. However, the rising demand considerably increases the energy consumption ofVMs, which has become a critical issue. High energy consumption not only translates to high energy cost, which can reduce the margin of profit of Cloud providers, but also high carbon emissions which aren't environmentally sustainable. Hence, energy-efficient solutions are required which will address the high increase in energy consumption from the attitude of not only the cloud providers but also from the environment [47]. This paper provides various insights about power consumption within the datacenters within the cloud computing environment. Most previous work focuses on reducing energy consumption in data centers for web workloads [48].

Problem statement

Specifically, considering previous studies and current platforms, there are at least three challenging problems in resources discovery and allocation in cloud computing [49]

1. How to find proper resource that satisfies customer requirements
2. How to reduce the incoming request's response time,
3. How to balance the workloads, when load is unpredictable.
4. How to reduce the energy consumption of the data centers while providing fair resource allocation.

III METHODOLOGY

A. Resource Discovery

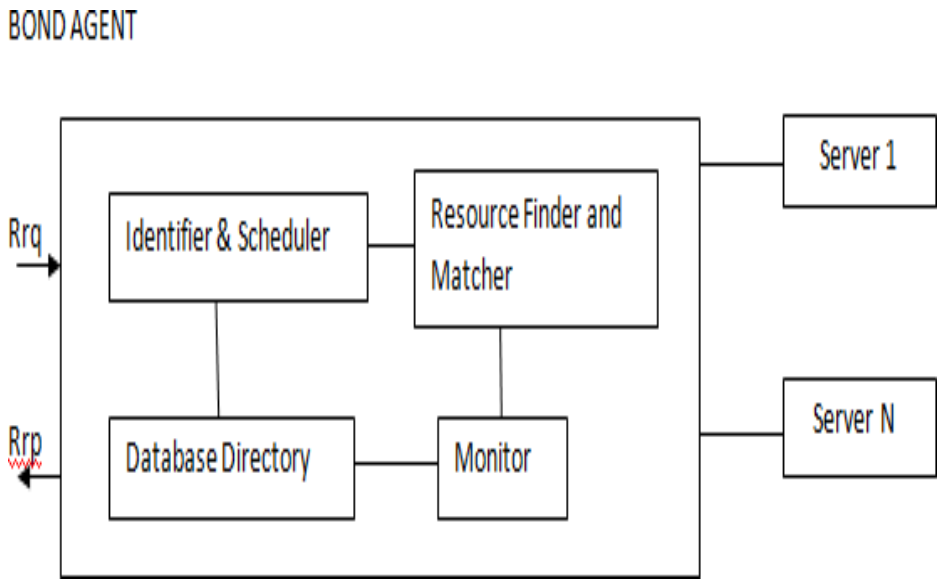


Fig. 1. BOND Agent based Resource Discovery

Bond is a Java-based distributed object system and agent framework, with stress on flexibility and performance. it's composed of (a) a core containing the thing model and message-oriented middleware,

(b) a service layer containing distributed services like directory and protracted storage services, and (c) the agent framework, providing the essential tools for creating autonomous network agents in conjunction with information of unremarkably used methods which enable developers to assemble agents with no or less programming. Bond Core, at the guts of the Bond system, there's a Java Bean-compatible component architecture. Bond objects extend Java Beans by permitting users to attach new properties to the item throughout the runtime, and provide a uniform API for accessing regular fields, dynamic properties and JavaBeans style setField /getField- defined virtual fields. this enables programmers equivalent flexibility as languages like Lisp or Scheme while maintaining the familiar Java programming syntax. Bond objects are network objects by default: they will be both senders and receivers of messages. [19]. No post-processing of the thing code as in RMI or COREA-like stub generation is required. Bond uses message passing while RMI or COREA-based component architectures use remote method invocation. This approach has the advantage that there's no single point of failure, and therefore the distributed awareness mechanism reconstitutes the network of directories even after catastrophic failures. [19]
In order to find suitable resources for every user, DSTC Architecture is used as a reference model. As like DSTC Architecture, the proposed framework contains three basic objects i.e. users, agent and server. The interactions between the objects can be classified into user-agent binding, agent-server binding, and server-server binding which grouped into multi-party binding. The interface type used here is a user interface. Agent used here is a Bond Agent. Bond is a Java-based, open source object-oriented middleware for network computing [19].In this paper we introduce an agent-based framework for resource discovery and allocation in cloud computing.

A. *Resource Discovery Algorithm Formulation* Consider r is a request from the user i and R denotes all possible resources in the server S. Resource request from user i is denoted as ri € R

Resource Request algorithm

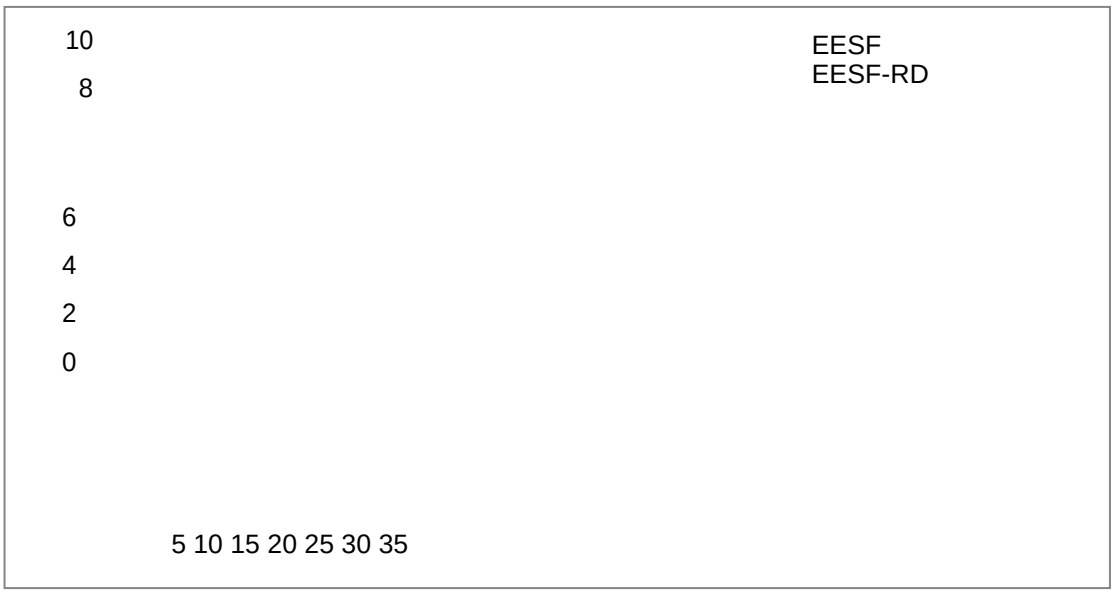
Begin
For all r€ R do
If ri€ AG &&match (ri=R) then
Send ri to the user from AG database Else if
Advertise ri to S then If ri€ S &&match (ri=S)
Send ri to user through AG Endif
Endif

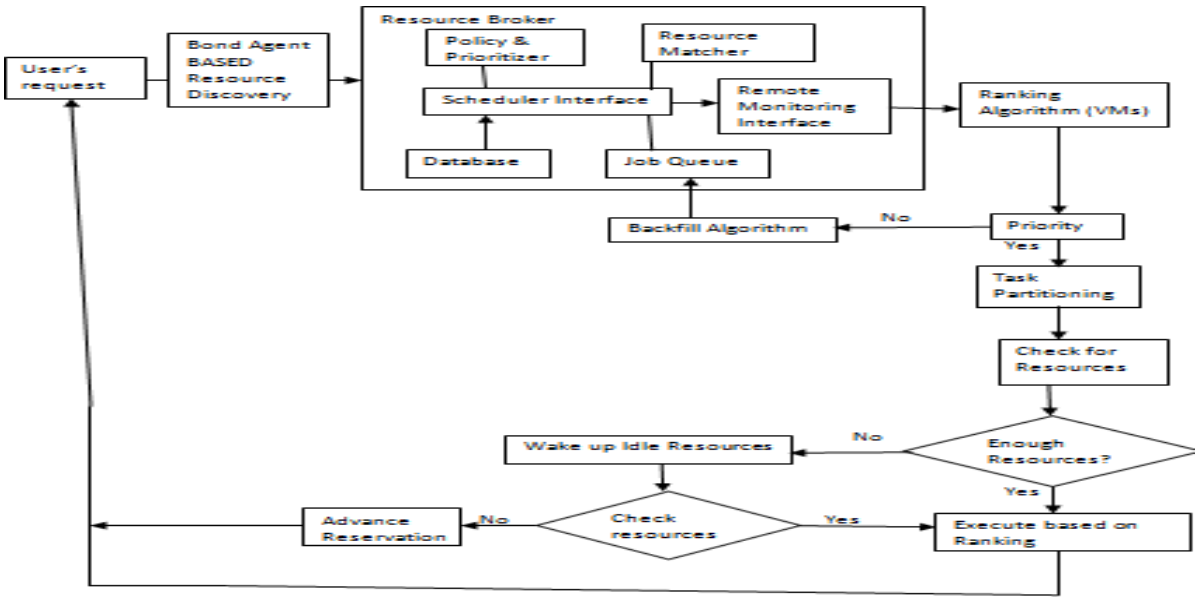
For i=1 to n do Send ri to i.S
Receive rresp(accepted_rreq_list, rejected_rreq_list) from i.S
Endfor

Endfor End
Resource Response Algorithm
Begin
For all ri € Sj do
If ri can be searched && ri is not already accepted then
Add ri to the accepted_rreq_list Elseif ri cannot be searchable then Send rito sj+1
Increment j+1 then goto step2 Repeat until time_frame >=10secs If time_frame<10secs
Add ri to the rejected_rreq_list Endif
Endfor
Send rresp(accepted_rreq_list, rejected_rreq_list) to AG
…….. End
An agent component consists of four parts i.e. Identifier and scheduler (IS), Resource finder and matcher (RFM), Database and Monitor. All are interconnected together and interacts using message passing. Once the user requests for a resource to the agent, the IS sends the request to RFM. If the requested resource is available in the agent's database, it immediately sends back to the user, if it is not available, RFM advertise the request to the connected servers using secure service discovery service protocol (SSDS). SSDS protocol is implemented on java and uses XML for service description and location. This protocol adds reliability, scalability and security features to the algorithm. If the server is busy due to network traffic or the resource is not available in the server, other connected servers will find the resource within a given time frame or else the advertisement will be rejected. Performance measure can be measure by using Time complexity – time taken to find a resource
Message complexity – number of messages sent to discover a resource.

A. Energy efficient Resource allocation

Bond agent based resource discovery is implemented in energy eficient scheduling framework proposed before [49]. Energy efficient resource allocation framework contains resource broker component, which provides basic functionality of the broker.





Ranking algorithm is used to rank the available resources. Backfill algorithm used to solve low priority jobs submited by the user. If available resources not available, advance reservation done to provies fair resource allocation. Finally the results will be sent to the user by message passing. Experiental results of the proposed work shows better performance than the previous framework.

IV. EXPERIMENTAL SETUP &SIMULATION RESULTS

In this section, the results have been evaluated. The project is implemented using the cloudsim [44] toolkit version 3.1 and CloudAnalyst for comparing load balancing. We have created 3 user base with the configurations. Service broker policy is choose as optimize response time and the load balancing policy across VMs is equally spread current execution load. Datacenter configured with linux os, x86 arch, with 2 physical hardware units. The cloudsim architecture is extended to provide the results. The proposed framework is compared with our previous framework. By evaluating the results, the proposed framework with resource discovery algorithm provides better completion time and fair resource compared with the previous one. Fig 3 shows the completion time factor with the previous energy efficient framework. Fig 4 shows load balancing of proposed framework. Fig 5 shows the detailed results of load balancing.

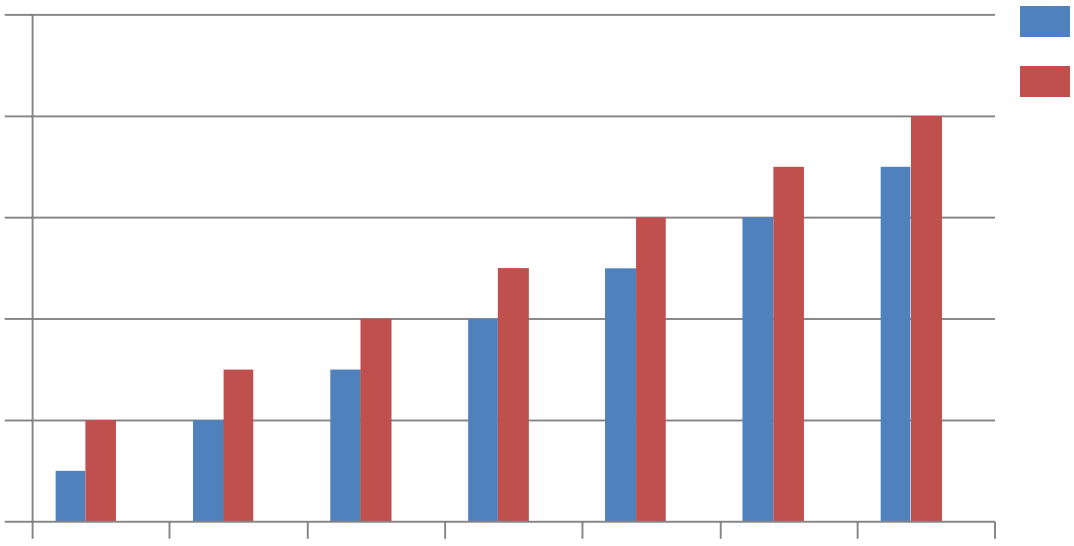


Fig. 3. Energy Efficient Resource Allocation with Resource Discovery

Fig. 4. Load balancing

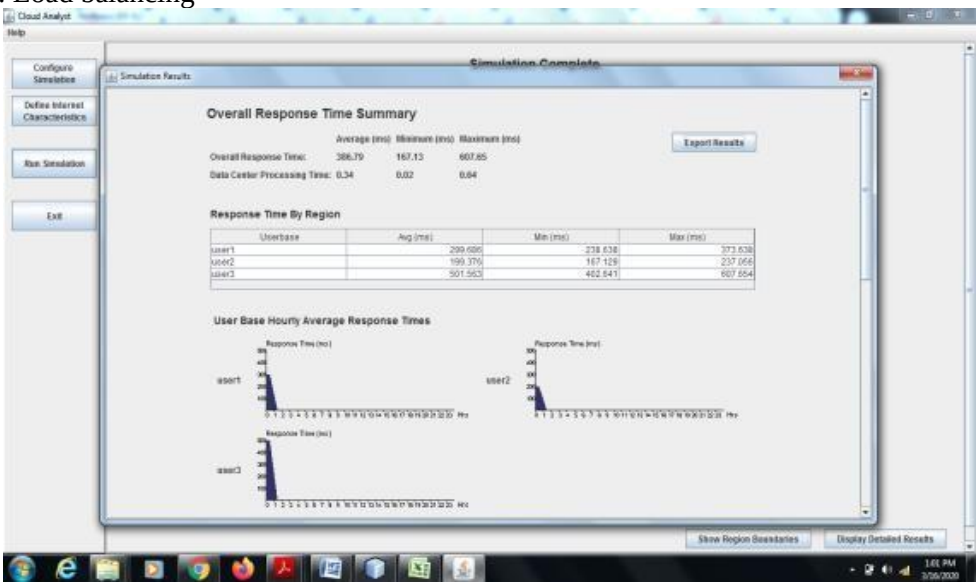


Fig. 5. Detailed Results of Load balancing

CONCLUSION

Cloud Computing has emerged together in recent research areas within the field of computer networking. Scheduling, which decides the way to distribute tasks to resources, is one of the foremost important issues. Reducing energy consumption has been an important technique for Cloud resources or datacenters, not just for operational cost, but also for improving system reliability. This paper mainly focuses on the discovery of resources, fair resource allocation, minimizing the completion time and energy consumption while balancing the load. Bond agent-based resource discovery is employed to seek out the simplest resource and to supply faster access of resources; hence it reduces the reaction time. We proposed an agent based resource discovery and resource allocation framework that considers the

energy consumption, load balancing alongside the fair resource allocation. Experimental studies show that our proposed work shows better performance compared with the prevailing job scheduling framework.

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