AN EFFICIENT ALLOCATION OF RESOURCES AT DATACENTERS USING HOD AND GSA

Sahil Goyal[1], Rajesh Kumar [2]
[1]*Lecturer, Computer Engineering Department, BGPC Sangrur E-mail: sahil.goyal@live.in,*
[2]*Assistant Professor, Computer Engineering Department, BGIET Sangrur E-mail: rajeshkengg@gmail.com*

Abstract

Enlarge utilization of resources from clients in a smart computing environment poses a greater challenge in allocating optimal energy efficient resources at the data center. Allocation of these optimal resources should be carried out in such a manner that we can save the energy of data center as well as avoiding the service level agreement (SLA) violation. This paper deals with the design of population-based energy efficient algorithm (MHODGSA) for optimized resources allocation at data center using combined approach of Modified Human Opinion Dynamic Algorithm (MHOD) and Gravitational Search Algorithm (GSA). The main idea is to integrate ability of exploitation in HOD with the ability of exploration in GSA to synthesize both algorithm's strength. Improving energy efficiency is multidimensional challenge regarding cloud computing environments management, which can directly reduce the operating costs and carbon dioxide emissions, while increasing the system reliability.

Keywords: *Cloud computing, Exploitation, Exploration, Datacenter, Social influence, Mass*

1. INTRODUCTION

Cloud computing is a process in which cloud issuing the computing services over the internet. Cloud services permit individuals and businesses to employ software and hardware those are directed by third parties at remote locations. Examples of cloud services include webmail, online file storage, social networking sites and online business applications. The cloud computing model permits access to information and computer resources from any location where a network connection is available. A shared pool of resources provided by Cloud computing, these resources include user applications, networks, computer processing power, and specialized corporate and data storage space. Cloud computing is a model for enabling appropriate, on-demand network access to a shared pool of configurable computing resources (e.g., Bandwidth, Servers, Ram, Applications and Services) that can be rapidly supply and release with minimum management efforts or service provider interactions[5]. For example: Instead of running an e-mail program on your computer, you log in to a Web e-mail account remotely. The software and storage for your account doesn't exist on your computer that is on the service's computer cloud. Cloud computing is an evolutional technology, by which we can access any computing resource through internet and authorize the sharing of resources much secure. It has started to enhance the cognition in corporate data centers. Cloud computing proceed from grid computing where enlarge utilization of virtualization at datacenter. It endows online resources and updated services expected for the users without changing their existing infrastructure. Due to increasing demand of cloud service, size of the data center also enlarging and more servers are required to obtain this demand. Hence, the data center generates more heat and more cooling devices are required to preserve the data center at a secure temperature resulting in more energy consumption and CO_2 emission. So, this is vital research area of Green Cloud Computing and hence there is a need of an energy efficient resources allocation at the data center in order to decrease the total energy cost. A recent study shows that these data centers will swallow 2% of the total worldwide energy

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consumption by 2020. The requisition for overall energy necessity at data center is increasing rapidly at the rate of 18% every year [7].

2. RELATED WORKS

Some algorithms have been proposed to solve the problem using mathematical solvers. Yu, Buyya, and Tham have a proposed a cost based workflow scheduling technique on the grid environment using the Markov decision process. However heuristic algorithms are more efficient in solving such problems, as mathematical solutions do not work well for high scale problems. Neeraj Kumar Sharma and G. Ram Mohana Reddy et al. proposed genetic algorithm for energy efficient virtual machine allocation at data center. Genetic algorithm (GA) capable of saving energy of data center and also its helps to avoiding the service level agreement violation. So, mainly this paper deals with the design of an energy efficient algorithm for optimized resources allocation at data center using combined approach of Dynamic Voltage Frequency Scaling (DVFS) and Genetic algorithm (GA).

3. PROBLEM FORMULATION

In the area of cloud computing for proficient allocation of resources at datacenters to client's request is becoming the wide area for researchers to provide an efficient approach of resource allocation. In Cloud computing, at the end of cloud server there are datacenters containing hosts with number of virtual machines, these machines act as the resources for the request of the client. For each request, on the basis of the requirements of request set of resources are allocated to those requests. But allocating those resources to the request proficiently is what we are searching for [1]. An energy aware approach has been redesigned in many research papers with some optimization algorithm to save as much energy of the datacenters as possible. There are many nature based optimization algorithm has been proposed in recent years which is been used in different field wherever optimization for something is expected. So we will try to formulate newer optimization algorithm for resource allocation with taking care of energy efficiency.

4. PROPOSED WORK AND METHODOLOGY

A new hybrid population-based algorithm is proposed with the combination of Modified Human Opinion Dynamics (MHOD)[3] and Gravitational Search Algorithm (GSA)[4]. The main idea is to modulate the exploitation ability of MHOD with the exploration capability in GSA to synthesize both algorithms' strength. The optimal Virtual Machine Scheduling or selection for current job will be done using the hybrid algorithm with both the standard MHOD and GSA algorithms in evolving best solution.

The hybridization of two algorithms can be done in high-level or low-level having a relay or co-evolutionary method approach. They can be either homogeneous or heterogeneous. In this thesis, we hybridize MHOD with GSA using low-level co- evolutionary approach which is also heterogeneous. The reason for the hybrid to be low-level can be attributed to the fact that the functionality of both algorithms has been combined. But the co-evolutionary approach is used since both algorithms are not used one after another. i.e. they both run in parallel. It is heterogeneous because there are two different algorithms that are involved to produce final results. The basic idea of MHODGSA is to combine the ability of social thinking in MHOD with the local search capability of GSA.

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In our hybrid algorithm, at first, all opinions are randomly initialized. Each opinion is considered as a candidate solution. After initialization, Gravitational force, gravitational constant, and resultant forces among opinions are calculated respectively. After that, the accelerations of particles are defined. The social ranks of agents are considered which is calculated on the basis of mass of each agent. This rank is utilized for weighting the updation of each agent according to the formula given by gravitational search algorithm. Thus the local search capability of GSA and social influence of MHOD are utilized and the results are compared.

5. MHODGSA ALGORITHM

- Step 1: Initialize population with random positions.
- Step 2: Calculate social rank based on their fitness function. Lowest fitness value has highest social rank.
- Step 3: Find the social influence Wij(t) of individual i and j.
- Step 4: Use social influence as a gravitational constant G.
- Step 5: Calculate mass(M) for each object according to their performance.
- Step 6: After calculating mass(M) find gravitational force as $F=G(M_1*M_2)/ R^2$

  where F → constitutes the magnitude of the gravitational force

  G → constitutes the gravitational constant which is S.I.

  M1, M2 →constitutes the mass of the first and second objects

  R → constitutes distance between the two objects.
- Step 7: Calculate acceleration(a) as $Fnet_1/M_1$.
- Step 8: Calculate Velocity(V) as $V_2=(V_1+a_1)*t$ where t is constant time V_1 is previous velocity.
- Step 9: Calculate the updated position as $P_2=(P_1+V_2)*t$ where P1 is previous position of object.
- Step 10: These steps are repeated until particles to converge as expected to provide optimal solution.

6. RESULTS

To carry out the simulation of the proposed algorithm based on Modified Human Opinion Dynamics and Gravitational Search Algorithm in load balancing over cloud computing, we have used Cloud-Analyst developed by cloud-bus using basic cloud-sim toolkit which provide and interface for developing and integrating our proposed approach. In this simulator, to get appropriate result we have to set the configuration of the Virtual machine at the end of cloud server over the Datacenter part of cloud. Different result has been evaluated using different environment for the same algorithm. In Cloud-Analyst, we have to set the number of datacenter over the world and the configuration of virtual machine which has been placed over every datacenter. Along with that we need to create client i.e. user base, which actually request datacenters depending upon the policy for choosing datacenter, here we are using closest datacenter policy to select the datacenter to execute user’s request over the cloud.

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Figure 6.1 Main Screen after configuring environment

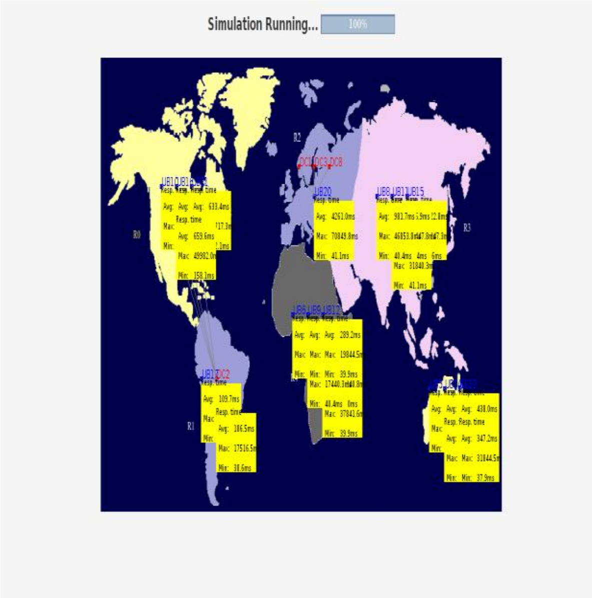

Figure 6.2 Simulation Complete Frame

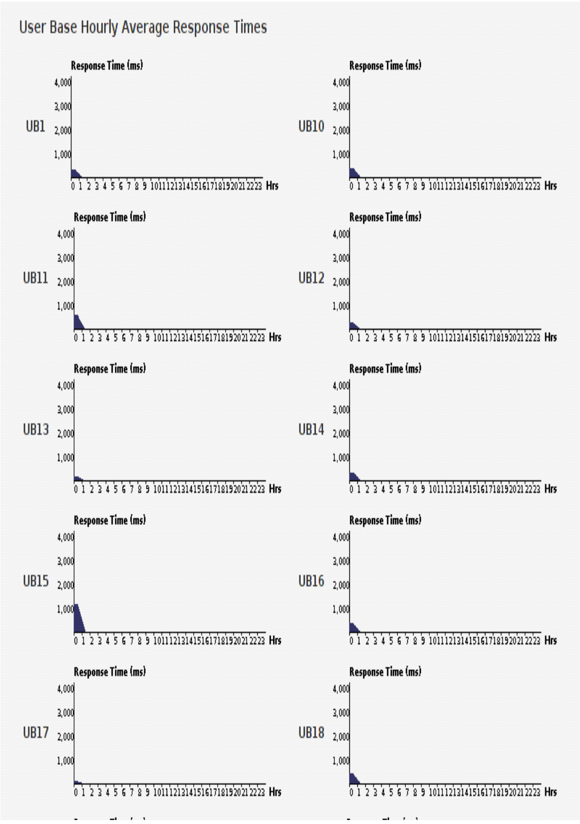

Figure 6.3 Userbase hourly average response time

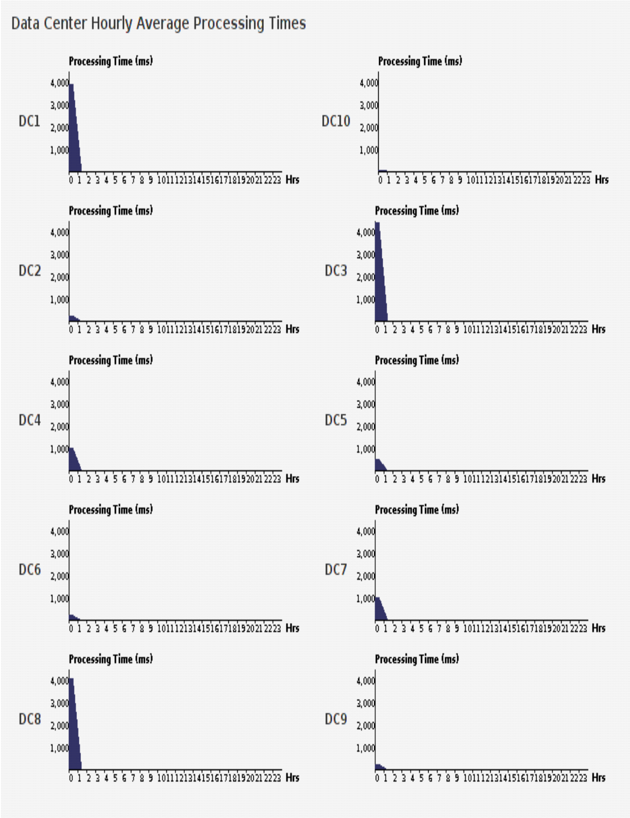

Figure 6.4 Datacenter Hourly average processing times

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To view the graphs of response time and request time at each datacentre and user base one can export result from view result screen as shown in figure 6.3 and figure 6.4. Figure 6.3 shows the hourly average response time taken by the each userbase for the simulation of 10 datacenters and 22 userbase. Figure 6.4 shows the hourly average processing time taken by each datacenter for the simulation of 10 datacenters and 22 userbase which is represented as configuration C_3 in Table 4.

Three different Configurations (C_1, C_2, C_3) has been set to get the desired output of the simulator. The actual parameter of both the configurations is provided in the table below. Table 1 describe the hardware detail of datacenters and the policy it will use for virtual machine. Table 2 describes the cost of different parameter over the datacenters. Table 3 describes the userbase configuration corresponding to the request generated at the end of userbase. At last Table 4 describe the different pair of userbase and datacenter for each configuration against which Modified Human opinion dynamics and Gravitational search algorithm has been tested.

Table 1 Physical hardware detail of datacenter

Memory (Mb)	**Storage (Mb)**	**Available BW**	**No. of Processor**	**Processor speed**	**VM Policy**
204800	100000000	1000000	4	10000	TIME_SHARED

Table 2 Datacenter configuration

Arch	**OS**	**VMM**	**Cost per VM**	**Memory cost per VM**	**Storage Cost per VM**	**Datacentre transfer cost**	**Physical HW unit**
X86	Linux	Xen	0.1	0.05	0.1	0.1	2

Table 3 Userbase configuration

Requests per User per Hour	**Data size per request**	**Peak hour start**	**Peak hour end**	**Average peak user**	**Average off peak user**
60	100	3	9	1000	100

Table 4 Different set of Configuration

Configuration	**No. of User base(UB)**	**No. of Datacentre (DC)**
C1	10	4
C2	15	8
C3	22	10

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After setting the defined configuration over the cloud in the cloud-analyst different result has been came out which has been displayed in figure 6.5. The graph represents the Overall response time and Datacenter processing time against the total execution time for the simulation in milliseconds. The graphs shows that over all response time kept on decreasing as number of datacenters increases because of the sharing of the load among datacenter which provides parallelism and saves execution time for the job or request. Since request has been shared among different datacenters, the number of requests per datacenter become less and hence reduces the processing time of datacenter for the request. To compare the result of proposed algorithm, same environment had been applied with Human Opinion Dynamics algorithm whose result are shown along with Modified Human Opinion Dynamics and Gravitational Search Algorithm in figure 6.6 and 6.7. From the two figures it can be observed that time taken by HOD is more than MHODGSA.

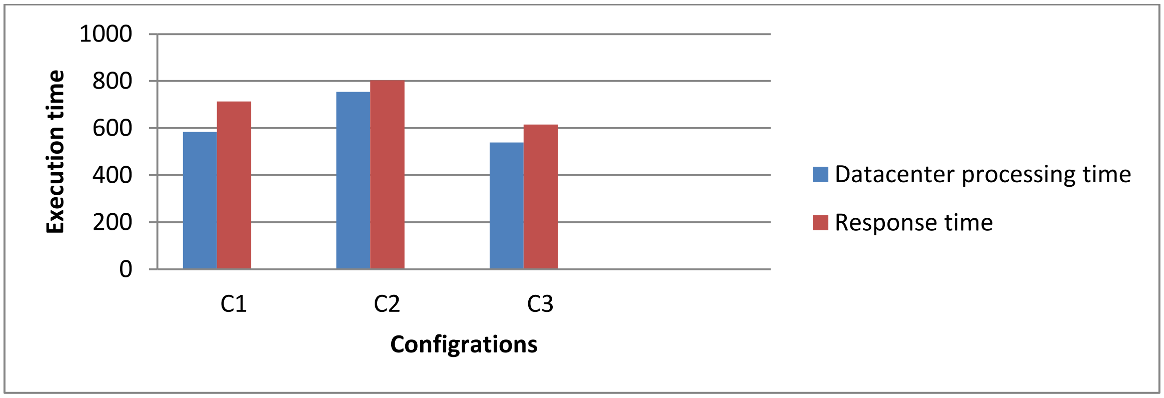

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Figure 6.5: Graphical Representation of Results

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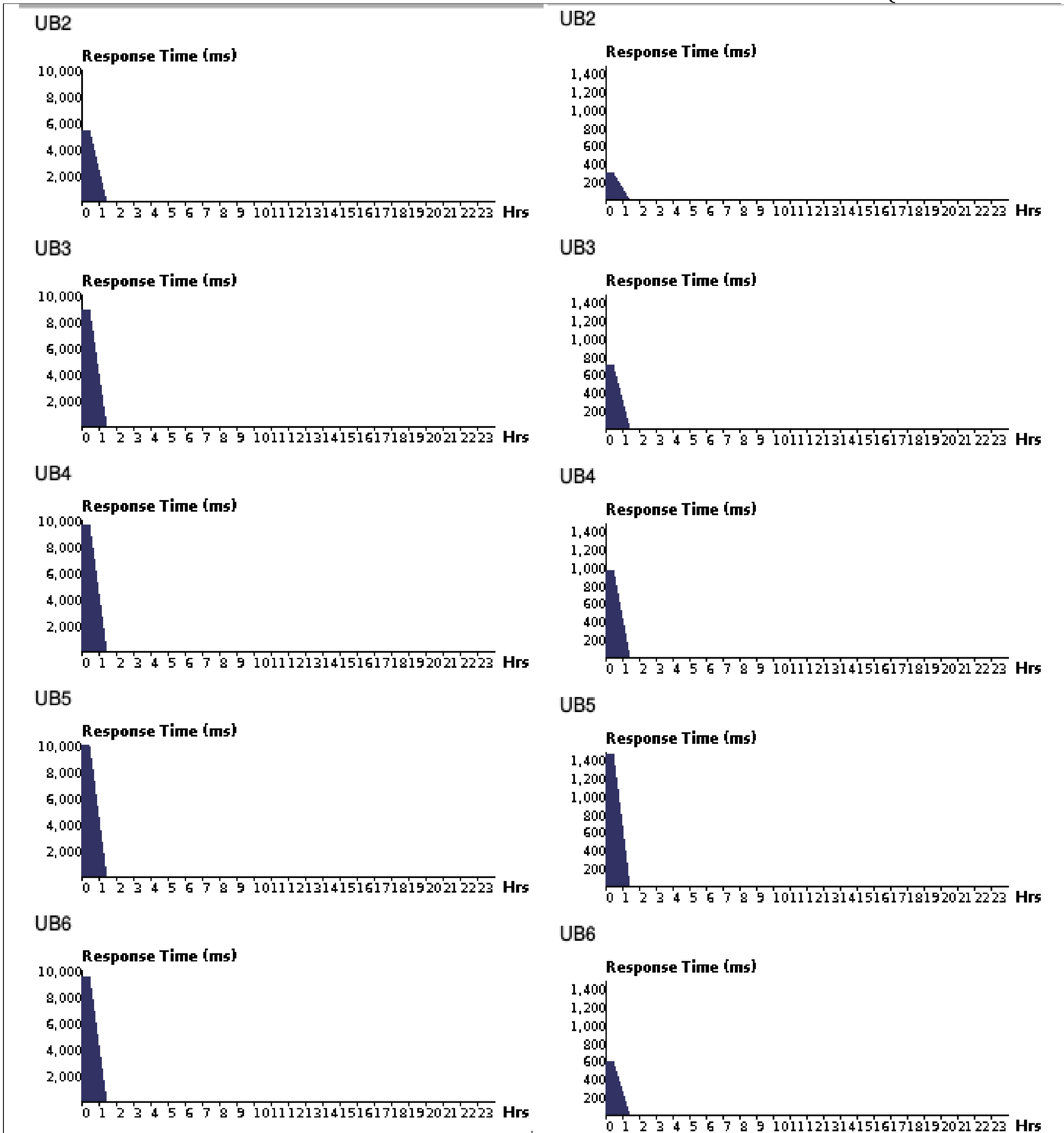

Response time with HOD for 10 UB and 4 DC	Response time with MHODGSA for 10 UB and 4 DC

Figure 6.6: Comparison of Response time between HOD and MHODGSA for configuration C_1

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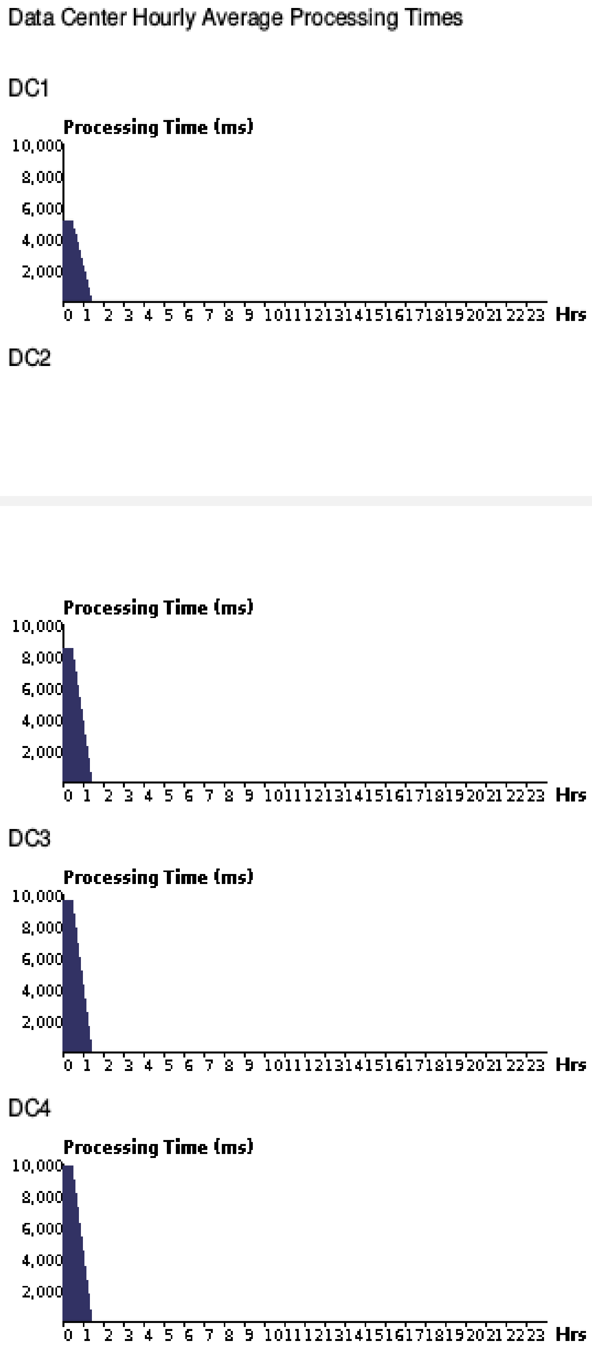
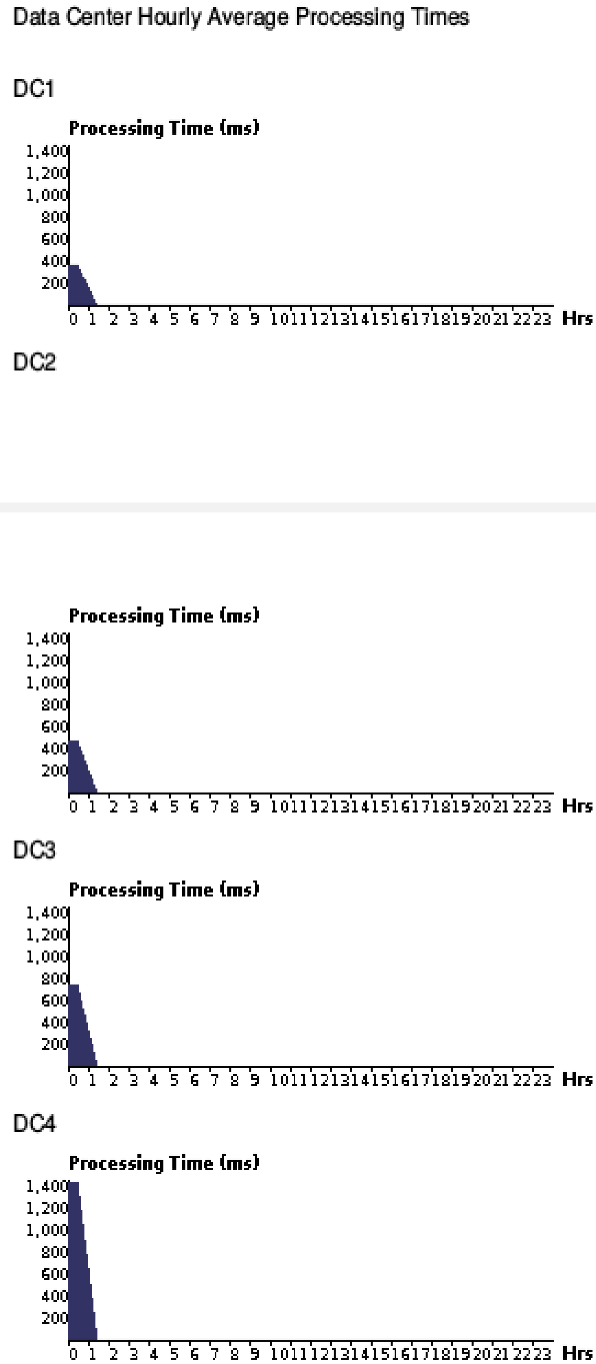


Datacenter average processing time with HOD for 10 UB and 4 DC



Datacenter average processing time with MHODGSA for 10 UB and 4 DC

Figure 6.7 : Comparison of Processing time between HOD and MHODGSA for configuration C_1

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7. CONCLUSION

Efficient virtual machine scheduling has become a vide area of research in the field of cloud computing where actual computation happened over cloud. All the task and jobs are executed over these virtual machines, therefore it become more important to utilize these machines over the cloud effectively with the recently coming optimization technique. Here we implement Human opinion dynamics based algorithm with Gravitational Search Algorithm. Here we compared this proposed algorithm with Human resource dynamic algorithm which showed a quite supporting result as compared to the HOD algorithm. Since various optimization algorithms are being coming up in near future which shows that there won't be any end until researcher are keep finding the relation between the various nature's algorithms. So, there won't be an end to keep finding the better virtual machine scheduling over the cloud computing to balance the load over the cloud.

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Authors

Sahil Goyal is M.Tech(Research Scholar) at Bhai Gurdas Institute of Engineering and technology, Sangrur. He is having 6+ years of teaching experience. During his tenure of services he has published national and international Research papers in the area of Computer science and Engineering (Research Area-Networking).

Rajesh Kumar is Assistant Professor at Bhai Gurdas Institute of Engineering and Technology, Sangrur. He is having 10+ years of teaching experience. During his tenure of services he has published national and international Research papers in the area of Computer science and Engineering. Currently, he has done Ph. D.degree in the area of Computer Networks.

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