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Job Scheduling Based on Dependent and Independent Task using Particle Swarm Optimization

Rajinder kaur, Kiranbir kaur

Abstract: ***Mobile Cloud Computing is an accumulation of both Cloud Computing and Mobile Computing. In cloud computing resources are deployed to a client on-demand basis. Mobile cloud computing is similar to cloud computing except that some devices involved in mobile cloud computing should be mobile. The demand for MCC has been increasing due to its scalability, reliability, high QOS (Quality Of Services), longer battery life, large storage capacity. Mobile cloud computing aims to take benefit of limited resources provided by a cloud provider. Task scheduling is a major concept involved in executing a task. In cloud computing job scheduling is required to execute each job without any deadlock. But the scheduling of dependent tasks is a problem in cloud systems. This problem is an NP-complete problem and can be solved using various heuristic and meta-heuristic approaches. These approaches give high-quality solutions with reasonable execution time. Particle Swarm Optimization (PSO) is one of these meta-heuristic approaches that solve the problem of grid scheduling. In this paper, we address the problem encounter in dynamic scheduling. In dynamic scheduling, each task has its own deadline completion time. The task that arrived earlier in the system occupied the resources first and later arrived tasks are rejected because their execution time exceeds the deadline. In this paper, we proposed PSO with a variable job identifier that identifies independent and dependent tasks from the population. The particles are arranged with a grid dynamically and influence swarm to minimize execution time and waiting time simultaneously. The experimental studies show that the proposed approach is more efficient than other PSO based approaches as described in the literature.***

Keywords:- Fault tolerance rate, particle swarm optimization, virtual machine optimization, cloudlets.

I. INTRODUCTION

As wireless technology is developing day by day, the importance of mobile devices has been increasing. With the help of hardware technologies like CPU, large memory storage mobile devices can compute complicated tasks. Resources on the physical machine are constrained henceforth may not be available as and when required. Advance computing transformed the services that are delivered to the destination like other normal services such as water supply, telephony, and gas.

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***** Correspondence Author
Rajinder kaur*, Department of Computer Science & Technology, Guru Nanak Dev University, Amritsar, India.
Kiranbir kaur, Assistant Professor, Department of Computer Science & Technology, Guru Nanak Dev University, Amritsar, India.

The applications of advance computing allow virtual systems to provide physical services. Advance computing comes out with a risk-free supra system in which anyone can have control. Different users can participate in it. Sometimes user applications require resources immediately. The resources required by these applications may be computational. The service required under this scheme of thing is known as Infrastructure as a Service(IaaS)[1]. [2]. It is critical to Construct, develop, and manage these resources. These services are managed by maintaining the Platform as a Service(PaaS)[3].

Distinct vendors claim to provide cloud services. Services include large storage capacity, longer battery life, computation and application hosting. To acquire these services, a user needs to satisfy SLA(Service level agreement). Customer needs to pay only for those services, they have utilized. Hence the user has to pay as they utilized resources[4]. In cloud computing, two different parties exist Cloud Service Provider and Cloud Service Consumer.

The cloud service provider provides services and resources to its client's on-demand basis and charges a bill according to pay per use [4]. A critical property of cloud is a lack of centralized ownership. So elasticity of service is also present in this case. [5] Cloud computing enables a user to add or remove resources according to their requirement. Cloud computing contains four deployment models: Public Cloud, Private Cloud, Community Cloud, Hybrid Cloud.

The public cloud is owned by cloud service providers (third party). Public clouds are available on a subscription basis (pay as you go). Public clouds are available to the general public. Data security and privacy are less in public clouds. Private clouds are owned by an enterprise or organization. Each company has its own data center. So, security has been enhanced in the private cloud. The cost of a private cloud is very high. The general public is unable to access the private cloud. The cloud which is shared by the multiple organizations that have the same concern is referred to as a community cloud. In hybrid-cloud public and private clouds are utilized seamlessly [3].

Cloud services are commonly listed in terms of visualization. Visual computing and gaming services are unique features listed in the armory of the cloud. Advance computing services are an enhanced version of the normal services. Physical machines may not be capable enough to handle and provide services to users. Heavy games required hardware as well as software resources. Physical machines with the older platform may or may not be capable enough to support such services. To tackle such situations, cloud services become critical.

Hence advance computing provides real-time gaming services. The user machines act as a source of input and output only. All the processing is done at the cloud end. The game events are captured by the users. These captured events are then transferred to the cloud. These events are then processed. The obtained result is then transferred to the user machine. Powerful computation services and the platform is required in this case. Both 2D and 3D graphics can be handled using the visual environment provided with the help of advance computing. [6]

The adoption rate is increased to 40% in 2013 which indicates that the demand for cloud resources has been increasing day by day. When we require visual services, Infrastructure as a service (IaaS).The demand for visual services is more in gaming services. To provide optimal services to the user, energy consumption needs to be minimized. More and more users are utilizing these services since the service provided is cost-effective. These optimal cost-effective strategies are implemented by the use of a media cloud[7]. All types of services require a storage facility. Storage services provide storage facilities through advance computing[8].

As the rate of usage is increased so does the faults within the cloud. To tackle this issue, fault tolerance strategy with optimal VM that is selected by using particle swarm optimization and dynamic core partitioning is proposed through this literature.The rest of the paper is organized as follows: in section 2, we discuss the related work, in section 3, we provide a proposed system, in section 4, we provide result and performance analysis. In section 5, we conclude the paper, in section 6, we present the references.

II. RELATED WORK

We discuss existing fault tolerance and energy-efficient approaches that are used to improve the performance of cloud computing.

The author [9] proposed a resource reliability mechanism to tackle the needs of the clients. The client can request resources and allocation is done only if resources demanded by the clients are below the need. This algorithm increases the utilization of resources but decreases the fault tolerance. In[10], the author provides a scheduling scheme that optimizes the task workflow in mobile devices. The author optimizes the task workflow based on the frequency scaling factor, dynamic voltage, and whale optimization algorithm. To minimize energy consumption, DVFS has been used. The author simultaneously reduces the time and power required to execute a task. The author resolves the problem encountered in batch processing machines[11] that are arranged in parallel and whose processing power is different from one another. Furthermore, each task has different processing and releasing time. The author proposed a bi-objective ACO algorithm to reduce makespan and power utilization. Moreover, the author gives a mechanism of finding solutions to problems that contain complex constraints.

[12]proposed a fault tolerance mechanism with energy efficiency. The energy efficiency is achieved by the use of decreased consumption of additional resources through load balancing in the mobile cloud. [13]proposed a software configuration based mechanism to enhance fault tolerance in the cloud. The cloud computing mechanism used in this literature is software oriented. The bayesian faults are tackled through the software configuration process. The author [14] discussed the proactive and reactive fault tolerance mechanism. The fault tolerance mechanism based on proactive fault tolerance is proved to be better through this literature. When a task and provider both are dynamic[15], the scheduling problem is transferred into a max weighted bi-graph matching problem and then to an integer programming model. The author proposed an algorithm that is based on four steps: a collection of information on the offloaded task, establish mapping relationship, cost calculation, and optimal mapping. Dynamic Voltage Frequency Scaling [DVFS] is useful in reducing power consumption in workflow applications. As QoS plays a significant role in task scheduling, the author[16] proposes a model that resolves the issues of QoS management and also improves the cloud scheduler. The proposed model maximize response time, resource utilization and minimize time complexity. [17]proposed an elastic scheduling strategy to tackle faults within cloud computing. The checkpointing strategy is discussed in this literature. The save-point settlement mechanism is discussed through this mechanism. the effective placement of save-point initiate better fault tolerance in cloud computing. The author [18] proposed a criticality based fault tolerance mechanism. The primary parameter considered for this approach is cost. The cost is associated with each of the VM. The selection of a VM is based on past performance and the least cost. The distance-based approach is considered for enhancing the performance of the cloud.

A soft-error rate[19] occurs when the voltage level of the CPU is reduced improperly and inefficiently, it may lead to decreasing QoS and reliability of workflow applications. Moreover, workflow applications may fail to execute if the completion time increases. To resolve this problem, the author used an energy-efficient approach in DVFS enabled cloud data center by assigning tasks to suitable VM. The author[20], provides a mechanism to minimize the energy required for computation offloading while maintaining the completion time of a task into consideration. The author provides the eDors technique to minimize power utilization and time required by the task to execute.

For hybrid clouds, two efficient workflow scheduling strategies have been designed[21] to reduce monetary cost and to execute a task under a deadline constraint. The first approach i.e. DCOH helps in reducing the monetary cost while another approach i.e. MOH helps in optimizing makespan of workflow application under deadline constraint. In[10], the author provides a scheduling scheme that optimizes the task workflow in mobile devices. The author optimizes the task workflow based on the frequency scaling factor, dynamic voltage, and whale optimization algorithm. To minimize energy consumption, DVFS has been used. The author simultaneously reduces the time and power required to execute a task.

The conducted literature is based on selecting the best possible approach for fault tolerance.

The metaheuristic approach is not implemented in the existing literature for VM selection. The next section discusses the performance enhancement with the use of dynamic core formation with a swarm optimization mechanism.

III. PROPOSED SYSTEM

The proposed system is based on a particle swarm optimization approach for the selection of virtual machine and dynamic core formation is used to provide fault tolerance. Also if one virtual machine fails then load will be dispersed on the next core. In other words, core level virtual machine migration is proposed through this literature. The jobs are partitioned into dependent and independent jobs by checking resource availability. In the case of resource requirement is more than jobs are dependent otherwise job are categories as independent. The methodology of the proposed system is given in fig 1.

A. Tools Used

The simulation utilizes Netbeans and clouds that is java based environment. The methodology for the proposed work is implemented using cloudsim 4.0.The simulation mechanism, first of all, initializes the clouds. Once the clouds are initialized, the datacenter is created. The data centers provide resources to virtual machines. The virtualmachines are given propionate resources corresponding to the datacenter. The broker initialized for the simulation determines the optimal VM and assign cloudlets to the virtual machine. The virtual machine capacity is the critical parameter determining load over the host machine. As the load over the host increases, the host may deteriorate. Then jobs are divided according to resource availability. This will handle jobs efficiently so execution time and waiting time are decreased.

B. Methodology

The flow of the proposed system is given in terms of a flowchart. The flowchart describes the flow of information in the system (figure 1).

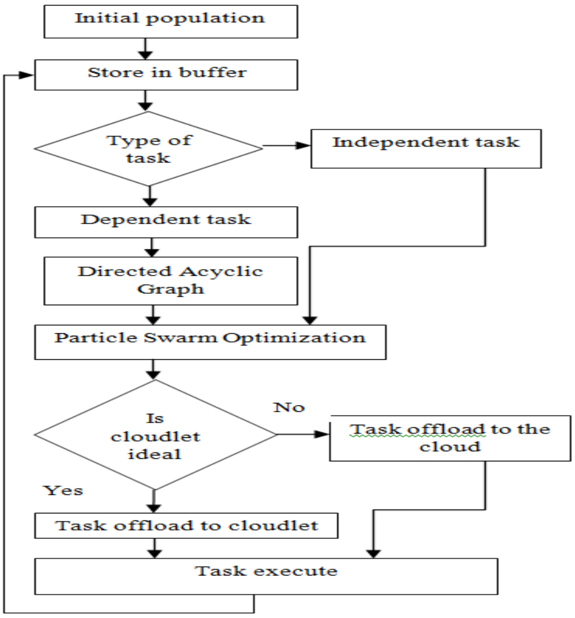

Figure 1: Flow of proposed system

The proposed system uses the swarm optimization mechanism to select the optimal virtual machine and then dynamic core formation is used to introduce parallelism. The parallel job execution enhances performance in terms of execution time.

IV. PERFORMANCE ANALYSIS AND RESULTS

The performance analysis is conducted based on Waiting time and Execution time possessed by various cloudlets. Waiting time is the total time taken by the machine to complete the execution. The Execution time is the time required to execute a job. The schedule of the jobs is prepared using a swarm optimization approach. This approach then divides the virtual machines into cores depending upon the load they possessed. The load partitioning and VM selection is the base of this literature. The results in terms of Waiting time is given as under.

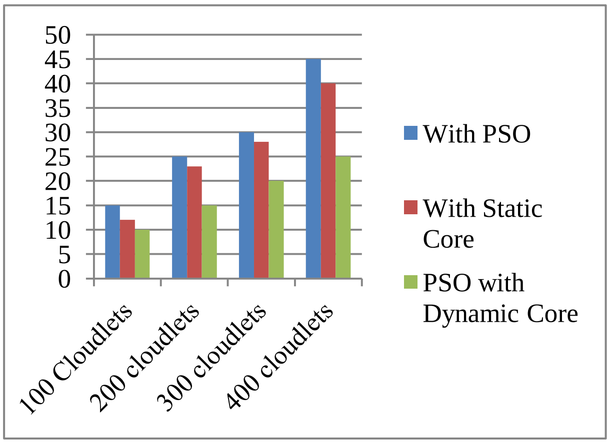

Figure 2: Cloudlet variation and Waiting time with distinct cloudlets

The Execution time that is a time requires to execute an individual schedule is given in figure 3.

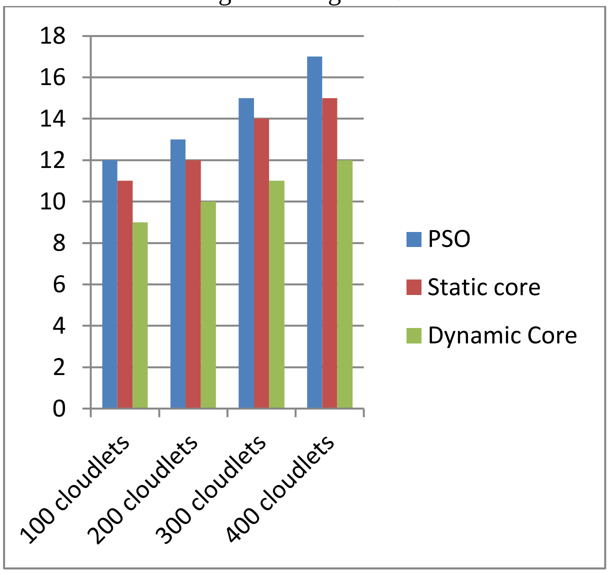

Figure 3: Execution time of the schedule

The fault tolerance is increased by the use of a dynamic core mechanism. The mechanism is modified in the VM selection policy. The fault tolerance rate is given in figure 4.

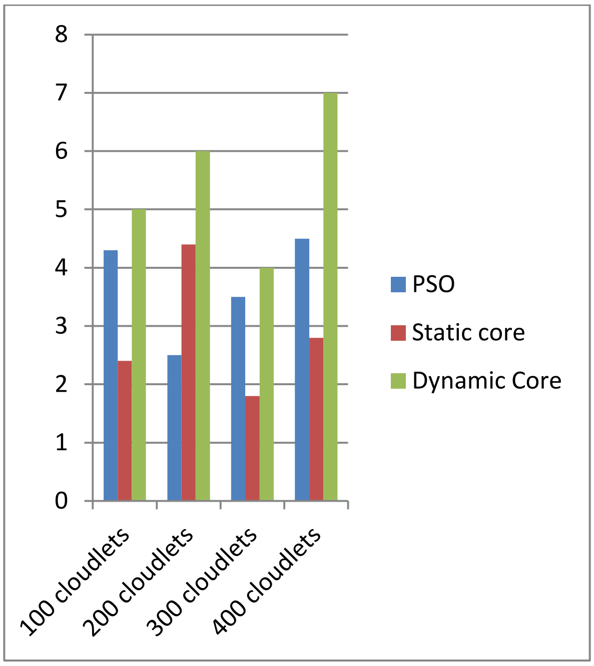

Figure 4: Fault tolerance rate

The fault tolerance rate with the proposed system is considerably improved. This mechanism ensures better performance only when the number of cloudlets is high. The static core mechanism causes a problem at a high cloudlet rate. On the other hand, the dynamic core mechanism performs better at high cloudlet rate.

STEPS:

Firstly the user needs to login to if it is already registered otherwise user needs to sign up.

Figure 5: User login page for registered user

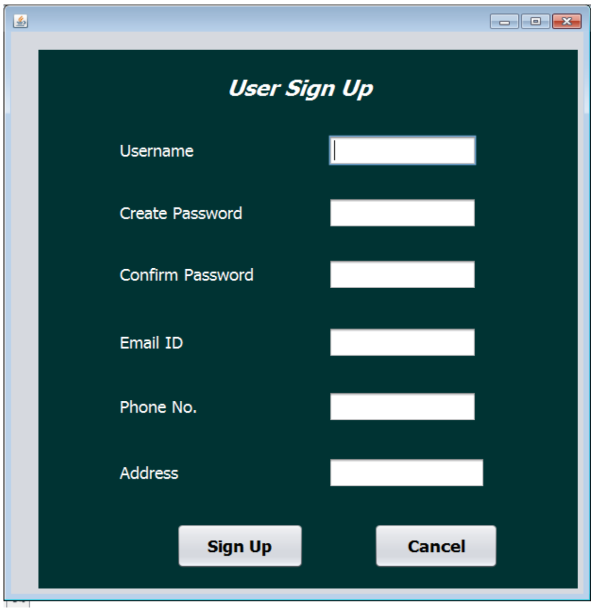

Figure 6: signup page for not registered user

After login, the following screen appeared in which the data center, virtual machine, cloudlet tab is given.

Figure 7: Main screen

On clicking on the datacenter tab the following options appear, In this user can create, update and delete the datacenters.

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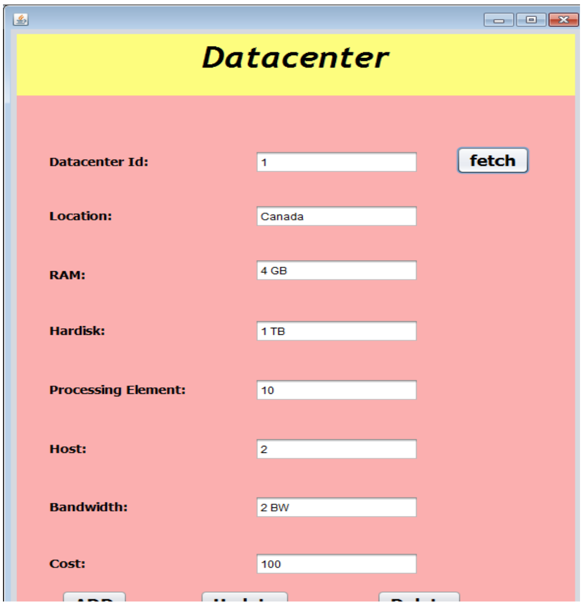

Figure 8: Datacenter creation page

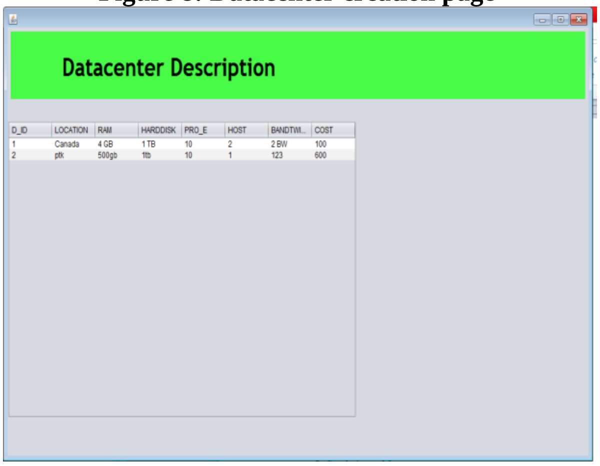

Figure 9: Users entered datacenter list

On clicking on the virtual machine tab the following options appear, In this user can create, update and delete the virtual machine.

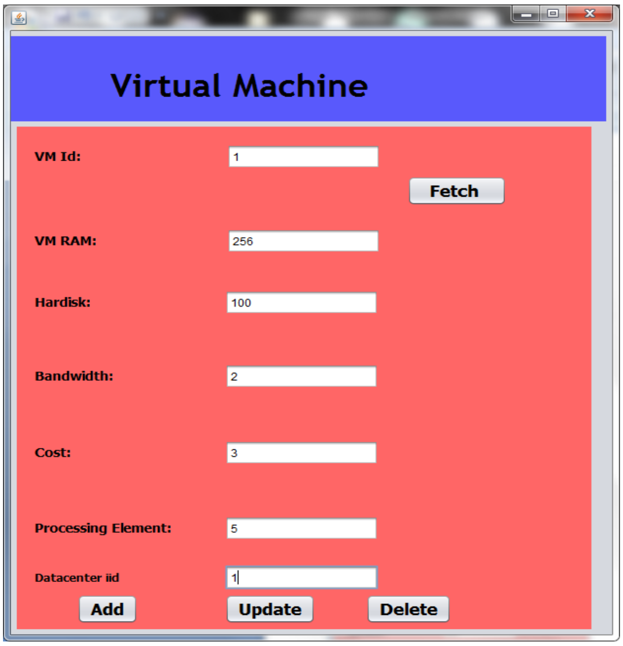

Figure 10: Virtual machine creation page

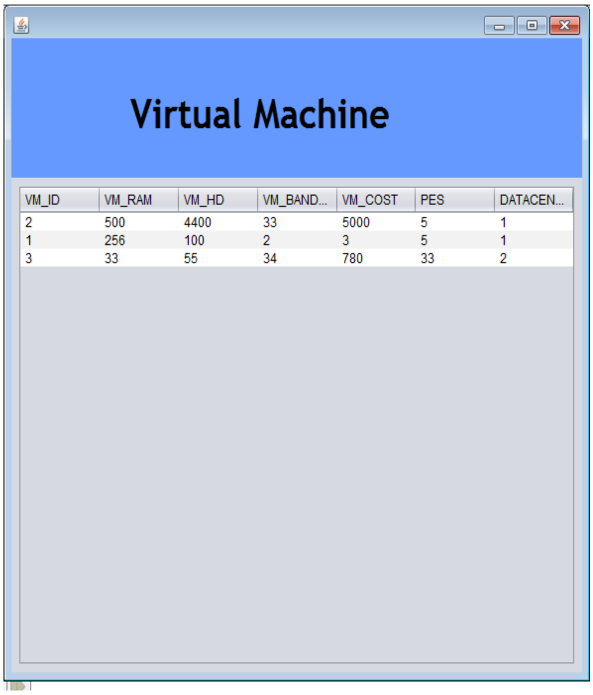

Figure 11: Users entered the virtual machine list

On clicking on the cloudlet tab the following options appear, In this user can create, update and delete the cloudlet.

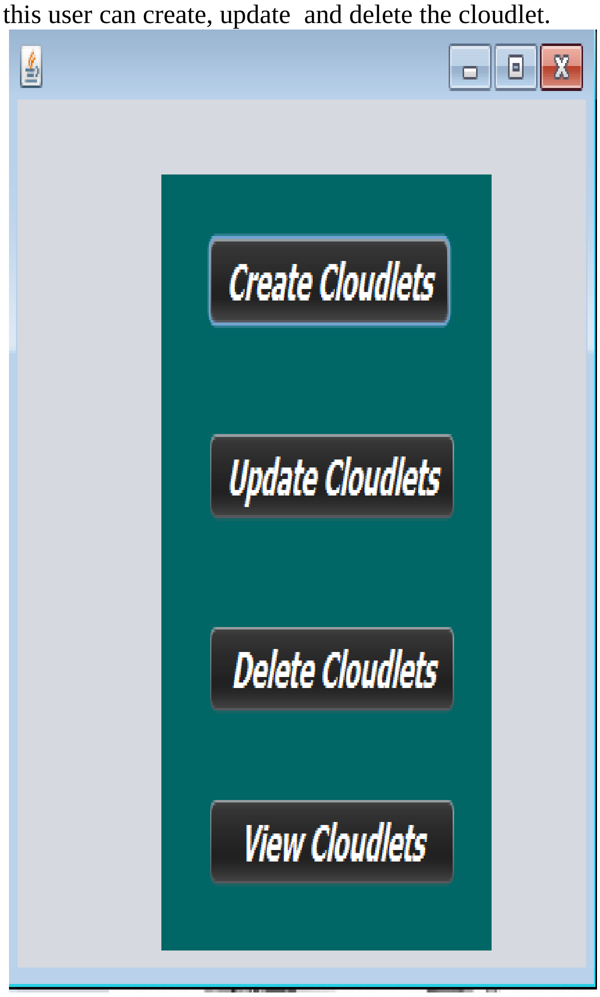

Figure 12: After clicking the cloudlet tab

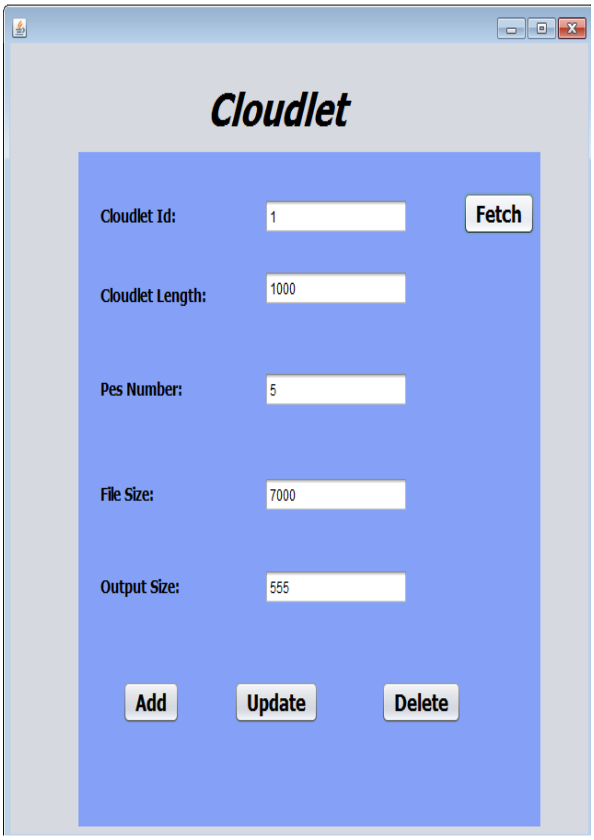

Figure 13: Cloudlet creation page

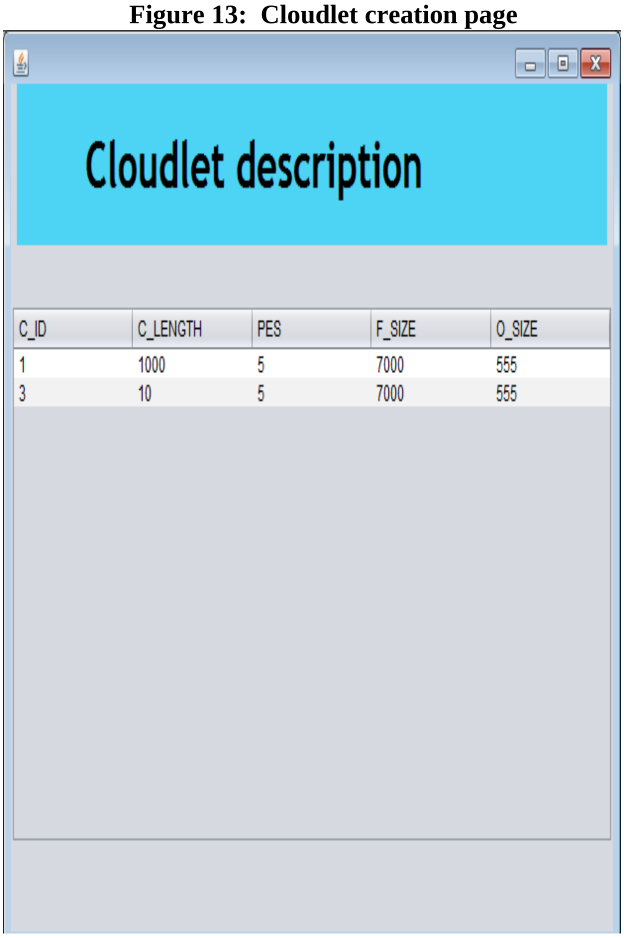

Figure 14: Users entered cloudlet list

After entering the data center, virtual machine and cloudlet user click on the apply algorithm.

This would apply the PSO algorithm on fetched data from datacenters by broker.

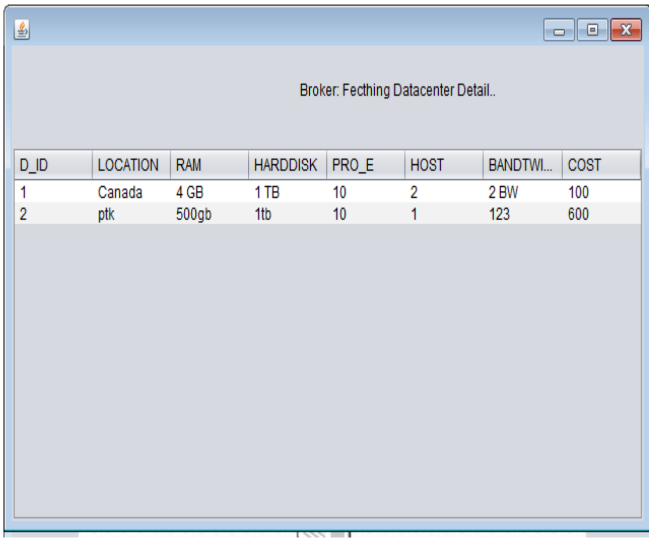

Figure 15: Fetching of data by the broker from datacenter

The results are evaluated in terms of waiting time and execution time that is shown as given below:

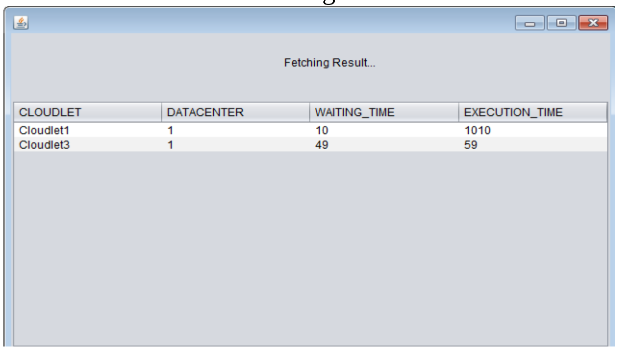

Figure 16: Showing the result after applying the algorithm

V. CONCLUSION AND FUTURE SCOPE

In this paper, we address the problem encounter in dynamic scheduling by using an particle swarm optimization algorithm. The task that arrived earlier in the system occupied the resources first and later arrived tasks are rejected because their execution time exceeds the deadline. Dynamic core formation is a second step with the proposed system. Initially, the VM selection policy is modified by the use of a metaheuristic approach. We use particle swarm optimization in our proposed system. At each distinct phase, the size of population is reduced. The reduced population allows quick convergence of the virtual machine. The virtual machine selected through this mechanism is partitioned into cores depending upon the load assigned. The overall mechanism gives a better result in terms of Waiting time, Execution time and fault tolerance rate.In future artificial intelligence along with the proposed system can be used for enhancing utilization and fault tolerance rate.

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AUTHOR PROFILE

Rajinder Kaur, Department of Computer Science & Technology, Guru Nanak Dev University, Amritsar, India. Rajinder Kaur is pursuing M.Tech (CSE) from Guru Nanak Dev University, Amritsar. Her research interest include Cloud Computing. She did her Bachelors of Engineering in Computer Science and Technology from Global Institute of Management and Emerging Technology, Amritsar, India.

Kiranbir Kaur Kiranbir Kaur is an Assistant Professor in Department of Computer Science & Technology, Guru Nanak Dev University, Amritsar, India. Kiranbir Kaur is pursuing P.hd from Guru Nanak Dev University, Amritsar. Her research interest include Cloud Computing.