Meta Heuristic Approach for Task Scheduling In Cloud Datacenter for Optimum Performance

Salma Khanum, Girish L

Abstract— **Task scheduling and resource provisioning is the core and challenging issues in cloud environment. Processes running in the cloud environment will race for available resources in order to complete their tasks with the minimum execution time; it is clear that we need an efficient scheduling technique for mapping between processes running and available resources. In this research paper, we are presented a non-traditional optimization technique, which mimics the process of evolution and based on the mechanics of natural selection and natural genetics called Genetic algorithm (GA), which minimizes the execution time and in turn reduces computation cost. We had done comparison with Round Robin algorithm and used CloudSim toolkit for our tests, results shows that Meta heuristic GA gives better performance than other scheduling algorithm.**

Index Terms— Cloud Computing, Task Scheduling, Genetic Algorithm (GA), Round Robin

I. INTRODUCTION

Cloud computing is the booming area in the IT industry. It provides software as a service (SaaS), platform as a service (PaaS) and infrastructure as service (IaaS) to the user on demand and pay -as- you use model over the internet (Fig1). The cloud service provider (CSP) provides service to users' on request. As cloud become popular day by day the number of users also increasing and it's a tedious task for a cloud service provider (CSP) to respond to user's request. Hence we need an efficient task scheduling technique to schedule tasks to reduce complexity. Scheduling refers to the set of policies that meant to be performed by a computer system in an organized manner [2].Scheduling of task is also responsible for efficient utilization of available resources. The main objective of the scheduling algorithms in cloud environment is to utilize the resources properly while managing the load between the resources so that to get the minimum execution time [1].

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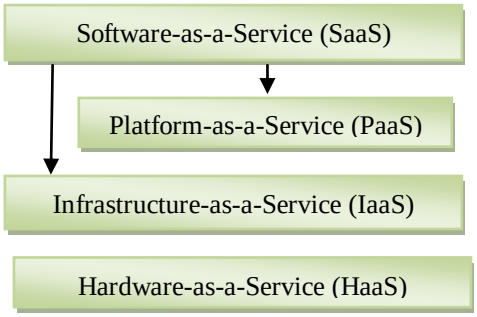

Fig-1 Service Model

A. CloudSim

CloudSim is cloud computing modeling and simulation tool developed in the CLOUDS Laboratory, at the University of Melbourne. It is used for the modeling and simulation of large scale cloud computing environment which includes the datacenter, virtual machine and Support for user-defined policies to allot hosts to VMs, and policies for allotting host resources to VMs and User-defined policies for allocation of hosts to virtual machines [14]. We used CloudSim as modeling and simulation tool, and shown the result in graph.

There are several task scheduling algorithm already exist like Min-Min, Max-Min, Suffrage, Shortest Cloudlet to Fastest Processor (SCFP), Longest Cloudlet to Fastest Processor (LCFP) and some meta-heuristics like Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Ant-Colony Optimization (ACO) and Simulated Annealing (SA).

In this paper, we are working on Round robin scheduling algorithm and Meta heuristic algorithm i.e., Genetic Algorithm (GA), by using CloudSim toolkit we are comparing the performance of both the algorithms and showing the analysis results. The rest of this paper is organized as follows: segment 2 tells about the review of the Related Work, segment 3 explains the existing algorithm i.e. Round Robin algorithm and segment 4 proposed system, the Meta Heuristic Genetic Algorithm, segment 5 implementation, segment 6 Result and Analysis and segment 7 conclusions and Future work of this paper.

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II. RELATED WORK

In this segment, we describe previous work done in the area of task scheduling in cloud computing. In paper [4] 2014 Ranjan Kumar, G. Sahoo used CloudSim as a toolkit to explain how the code related to cloudlets, datacenter and VM's used for test & analysis purpose. 2012 in paper [3] "A study on scheduling methods in cloud computing" the author helps to understand the wide task scheduling options so as to select one for a given environment. In paper [5] the authors had done survey on different scheduling algorithms, considering metrics for task scheduling .2014 Er. Shimpy, Mr. Jagandeep Sidhu, studied different scheduling algorithms in different environment with their respective parameters [1]. 2012, the author in paper [6] considered bandwidth requirement as a parameter for task scheduling; they showed that the proposed algorithm (BATS) has improved performance. In paper [7] author surveyed the various existing scheduling algorithms in cloud computing and arrange various parameters in tabular form. From the survey, the author noticed that disk space management is critical in virtual environments. In paper [8], the author, existing job scheduling algorithms are compared with different parameters like Complexity, Allocation, waiting time, Type of system. In paper [9], the author used Meta heuristic Genetic Algorithm and classifies the Tasks by Time and Budgetary Constraints (Cost, Deadline). In paper [10], the author discussed about the dynamic arrival of tasks, and allocation of resources is tedious for uncertain tasks [10]. In paper [11], the author emphasizes the independent task scheduling using Genetic Algorithm and Improved Genetic algorithm is compared and shown the result in graph. In this paper [12], the author discussed about a Scheduling model based on minimum network delay using Suffrage Heuristic coupled with Genetic algorithms for scheduling sets of independent jobs algorithm is proposed, the objective is to minimize the make span. In paper [13], the author proposed an improved genetic algorithm by merging two existing scheduling algorithms for scheduling tasks taking into consideration their computational complexity and computing capacity of processing elements. Experimental results show that, under the heavy loads, the proposed algorithm exhibits a good performance.

III. EXISTING ALGORITHM

Round Robin Algorithm

Round robin algorithm is the simplest algorithm which focuses on the fairness [2] and it is based on the principle of time sharing. Here time is divided into multiple time slices called quantum. It stores jobs in a circular queue and each job in a queue is assigned the same quantum of time. In the specified quantum of time the node has to perform its operation. If a job can't complete during its turn, it will be stored back in a queue and waits for its next turn to complete the job. Advantage of this algorithm is that it utilizes all the resources in balanced order and all the nodes are allocated with equal resources which ensure fairness. The drawback of this algorithm is here time quantum plays important role, if the time quantum is larger, than it behaves as FCFS, and if it is small than higher context switching.

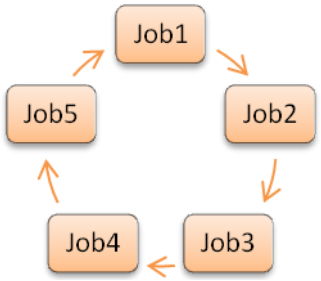

Fig-2: Jobs stored in a Queue

Algorithm1: Round Robin Algorithm

Step1: Begin

Step2: Create a ready queue of the Processes

Step3: Want to add another process means add to the tail of the queue

Step4: Pick the first process from the queue and allocate the CPU to it

Step5: Each process in the queue is allocated a time of 1 quantum, If
The process takes more than one quantum to complete its execution; Then
It removed after 1 quantum and placed at the tail of the queue

Step6: Repeat Step4

Step7: END

Drawbacks:

- Largest job takes enough time for completion [2].
- The power consumption will be high as many nodes will be kept turned-on for a long time.

There is an additional load on the scheduler to decide the size of quantum.

IV. PROPOSED SYSTEM

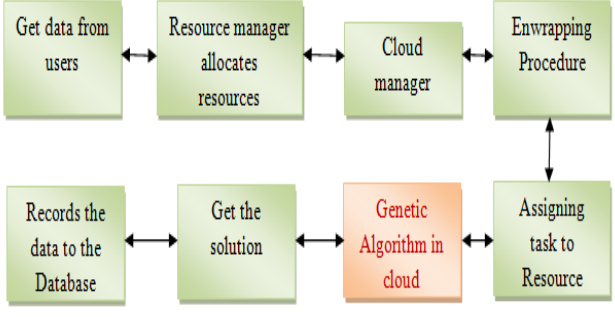

Fig-3 Proposed system of Task scheduling using GA

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In this segment we are going to see the detailed working of system architecture of the proposed system. Fig. 3 shows the system architecture where the users data is collected in terms of task and the resource manager allocates required resources needed and the cloud will call for the procedure and assign the task the targeted resources there by runs the Genetic algorithm to schedule task and records the details in the database.

Genetic Algorithm

Genetic algorithm is one of the scheduling methods, it is a search algorithm based on the mechanics of natural selection and natural genetics. It is a very powerful nontraditional optimization technique which mimics the process of evolution. Based on the concept of Darwinian Theory, "Survival of the fittest", the important steps involved in the process are, first initialize population, Fitness function, Selection, Crossover and Mutation as given below

- *Initial population*

  Initially many individual solutions are randomly generated to form an initial population. The population size depends on the nature of the problem, but generated randomly.

- *Fitness Function*

  Individual solutions are selected through a fitness based process, where fitter solutions are typically more likely to be selected.

- *Selection*

  During each successive generation, a proportion of the existing population is selected to breed a new generation, i.e. it is ready to use as solution.

- *Crossover*

  We use single point crossover that is only a part of the individual chromosome pair is exchanged where we choose a locus at which we swap the remaining part from one parent to other.

- *Mutation*

  After selection and crossover, we have a new population full of individuals. Here mutation is fairly simple where some value of genes are replaced by some other value in chromosome based on what you feel is necessary. Mutation is necessary to ensure the genetic diversity within a population.

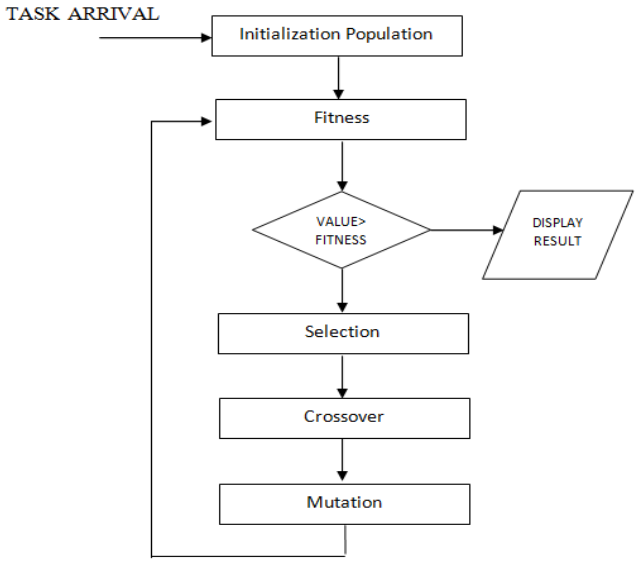

Fig -4: Flow diagram of GA

Algorithm 2: Genetic Algorithm

Step1: Begin Main

Step2: Create an Initial population with randomly generated individual solutions

Step3: Evaluate the fitness of each individual solution

Step4: Repeat
- Select fitter individuals for reproduction
- Recombine pairs of individual(crossover)
- Mutate the resulting individual
- Evaluate the fitness of the new individual
- Generate a new population

Step5: End Main

V. IMPLEMENTATION

Scheduling in CloudSim can be done at VM level and Cloudlet level, the simple implemented brokering inside CloudSim will iterate through all cloudlets and assign them to the available VMs one by one. For example if we have 4 VMs and 5 cloudlets, the broker will assign the first VM to run the first cloudlet, the second VM to run the second cloudlet, like wise up to fourth VM to run fourth cloudlet and then will start again with the first VM by assigning it to run the fifth cloudlet. Here the proposed algorithm allow assigning cloudlets to VMs in a different way, based on their MIPS value and length of the cloudlet for scheduling task to decrease the makespan of the workload and manages the load between resources. An optimum scheduling technique must reduce the execution time while utilizing the available resources efficiently. Fig.5 shows the network topology of CloudSim and the two levels of scheduling.

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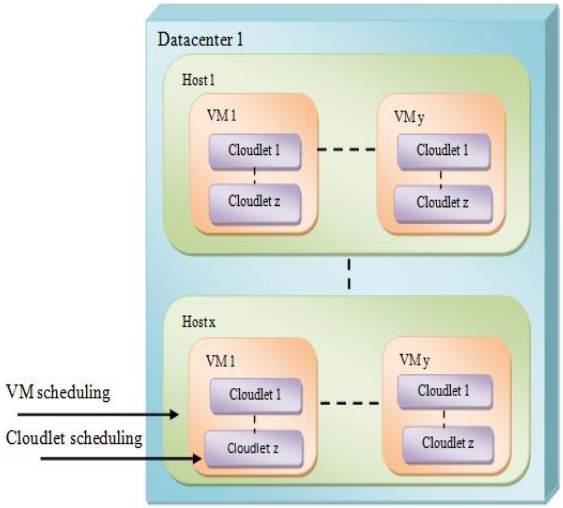

Fig-5 Describes Scheduling In CloudSim

In this paper we are implementing two vm scheduling algorithms that is Round robin and Genetic algorithm on Intel core i3 machine with 500 GB Hard disk and 4 GB RAM on Windows 8 operating system, Eclipse with Java version 1.7 with the help of CloudSim toolkit for modeling and simulation.

An optimum scheduling technique must reduce the execution time while utilizing the available resources efficiently. We used a RoundRobinDatacenterBroker and GeneticAlgorithmDatacenterBroker for our analysis in CloudSim. By randomly varying the number of cloudlets and keeping VM's constant and vice verse.

VI. SIMULATION AND ANALYSIS

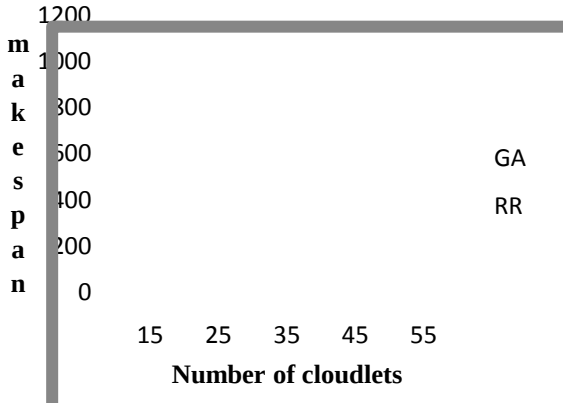

Chart-1 Makespan v/s No. of Cloudlets

Above chart-1 shows the analysis results, where we compared both algorithms based on the number of cloudlets and make span, it is the scheduled time of cloudlets and in fig 5 shows the cost verses the number of cloudlets.

PARAMETERS	VALUES
POPULATION SIZE	10
CROSSOVER TYPE	SINGLE POINT
MUTATION TYPE	SWAP
NUMBER OF CLOUDLETS PER MINUTE SENT	50
NUMBER OF VMS	5
NUMBER OF ITERATIONS	30
STOPPING CRITERIA	NO. OF ITERATIONS

Table -1 RR and GA parameters

VII. CONCLUSION

Scheduling is one of the core and challenging issue in cloud computing environment. In this paper we analysed two algorithms, Round Robin Scheduling and Genetic Algorithm; scheduling using round robin will results in largest jobs take enough time for completion of job and it is not suitable for heavy loaded jobs, low throughput and the power consumption is high as all nodes turned on for long time and there is an additional load on the scheduler to decide the size of quantum, hence we used Genetic algorithm as a scheduling technique which overcome the above problems and more efficient than other scheduling technique.

VIII. FUTURE WORK

In this paper we mainly discussed about two scheduling algorithms Round Robin and Genetic algorithm, we focused on the average waiting time of execution of tasks, in future we will take more tasks and check for the efficiency and we are trying to merge internally Round Robin scheduling to see the result .

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