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Dynamic Task Scheduling using Genetic Algorithm in Private Cloud Environment

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Abstract: ***Cloud computing is a technology which is used in most of the current business world. And also it has some challenges to overwhelm. The main obstacle in cloud computing is to manage resource utilization. To manage resource utilization in a perfect way we use task scheduling. There are many algorithms used for task scheduling. Here genetic algorithm is used for implementing task scheduling. Compared to traditional algorithms genetic algorithm gives enhanced results which improves quality of the process. In this paper multi objective is been focused. To maximize resource utilization, to minimize cost and time which gives optimized results and improved performance.***
Keywords: Cloud Computing, Task Scheduling, Genetic Algorithm, Max-Min and Min-Max Algorithm.

I. INTRODUCTION

Cloud computing is becoming a very demanding technology in the hands of developers and IT companies. Using Cloud Computing we can access whatever the information we needed and no matter where we are at and what time we need it, it can be accessed. But we cannot expect the same facilities in a regular computer. So, Cloud computing helps to do the work independently on physical location. Cloud computing has three types of services are provided by the cloud. First is Infrastructure as a Service (IaaS), which provides cloud users the infrastructure for various purposes like the storage system and computation resources. Second is Platform as a Service (PaaS), which provides the platform to the clients so that they can make their applications on this platform. Third is Software as a Service (SaaS), which provides the software to the users; so users don't need to install the software on their own machines and they can use the software directly from the cloud[1]. These Services are provided to the consumers through internet. However cloud computing has some obstacles to overcome. One of the major obstacles is resource utilization which is connected to task scheduling. Task Scheduling is the process of scheduling cloud consumers task to the applicable resources which can save time and cost by upgrading the execution of tasks. Scheduling a task is not that much easy task, to assign a task we need to consider execution time, cost and time taken to respond.

II. RELATED WORKS

Task Scheduling in cloud computing is a challenging problem in these years.
Kumar, P., & Verma,A.[1] has presented a system that generate initial population using min-min and max-min techniques and proportion selection method is used as the selection operator .kaur, k.,Chhabra,A.,& Singh,G.[2] has introduced a system that generate initial population using minimum execution time and min-min algorithm heuristics approach and one point and two point crossover is used. Tayal, S.[3] have proposed Fuzzy genetic algorithm optimization which is used in scheduling decisions which is made by evaluating the entire group of task in the job queue and initial population is randomly generated. kaur, S&verma,A.[4]has presented a system that generated initial population by using SCFP and LCFP techniques in private cloud environment and two-point crossover method is used. Mocanu,E. M.,Andreica,M I.,&Tapus,N [5] have proposed a system in which fitness function is based on deadline in order to regulate cost of delay and store that the customer satisfaction can be maximized.

A. Modification and Justification

Most of the work focus on single objective, where the cloud environment is expected to provide betterment in all aspects of satisfying a customer. So our proposed system provides a multi objective model for addressing the task scheduling issues in cloud storage.

B. Organization of the paper

The remaining section of the paper is arranged in such a way that, Section III specifies the methodology used. Section IV represents the experiment carried out in allocating VM with the incoming task. Section V provides the result and discussion. Section VI presents the conclusion.

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III. METHODOLOGY

A. Genetic Algorithm

Genetic Algorithm (GA) is a heuristic search algorithm based on the process of natural selection. GA is used to solve problems based on searching and optimization. And also it can solve the problems more effectively than the traditional algorithms. According to Charles Darwin's theory, the term "survival of the fittest" is used as a technique for task scheduling where the tasks are scheduled to the resources as per the value of fitness function for each task scheduling process parameters. The steps to be followed in genetic algorithm are:

1) *Initial Population:* The initial population is a group of all individuals to find out the optimal solution. Every solution obtained from the population is called as the individual. Each individual represent a chromosome for making it applicable for genetic operations. From the initial population some individuals are selected to form next generation. Specific methods are applied to select mating chromosomes.
2) *Fitness Function:* The main purpose of fitness function is to calculate the superiority of the individuals in an population. The fitness function varies on different cases. The individuals in the population withstand as per the fitness value or function value. Fitness function can be considered as an encouraging factor in genetic algorithm.
3) *Crossover:* Crossover operations main goal is to form a new individual tree by selecting two parent individuals and reorganize the parts of these parents. Single point crossover is used in this paper. Single point crossover is a process of selecting a intersection point oddly among the parents and to select the code before the intersection point from one parent and to select the code after the intersection point from another parent and merge the obtained codes from the parents to create a individual offspring.
4) *Mutation:* Mutation is the process after crossover operation. It is a process of substituting new code value to the chromosome to get a new offspring. Having this new offspring value efficient solutions can be obtained by the genetic algorithm.

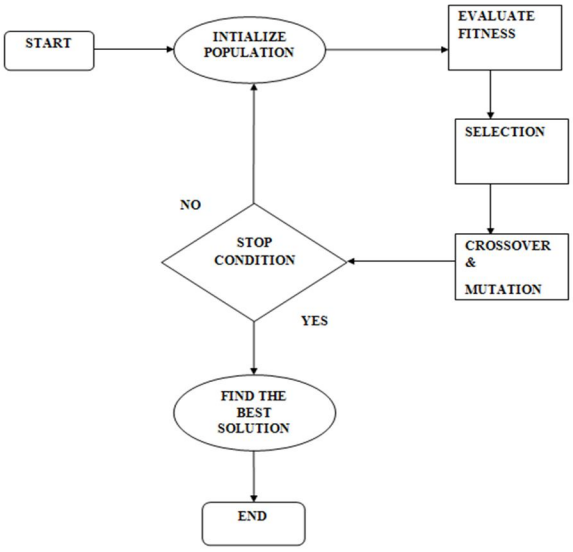

Fig.1. Genetic Algorithm

B. Task Scheduling

Cloud virtual machine(VM) is like a operating system that is installed in the system software which acts as a hardworking hardware. The process of virtual machine installation is done by software emulation and hardware virtualization. virtual machines are used to share resources. Several virtual machines can run on different operating systems like Windows, Linux ,Unix on a same physical host where the operating systems are isolated from each other. VM's consumes hardware in a more efficient way that can even reduce the quantity of hardware , maintenance cost , power etc. VM's can be reorganized without any difficulty among host servers to enhance hardware.

Task Scheduling is done on the basis of various parameters which can improve the total performance. Task is a work given by the user .The data center distributes the task on the basis of Service Level Agreement(SLA). Scheduling is a process to complete the work by assigning the work to the available resources. To gain a effective quality of service, multiple users are allowed to share system resource property.

C. Max-Min Algorithm

The process of Max-Min algorithm is to calculate how much completion time is needed for all the tasks on each machine and to find which machine process the tasks in minimum time .And minimum completion time task is selected among all the tasks and is scheduled to the machine which is expected to have minimum execution time . The list of tasks becomes empty as the process continues.

D. Min-Min Algorithm

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IV. PROPOSED SYSTEM

A. Genetic Algorithm based Task Scheduling

The main aim of this paper is to utilize maximum resource and to get minimum completion time and minimum cost. The process starts with collecting tasks from the user and organizing them on the basis of priority. The larger tasks takes high priority whereas the smaller tasks takes low priority. Once the tasks are arranged as per priority the machine load is calculated using Max-Min and Min-Min algorithm i.e. how much time the machine takes to execute a given task is calculated . And the machines are arranged in an order in an array. To reduce execution time the larger tasks are assigned to machines which has less machine load or the machine which has less execution time and smaller tasks are assigned to machines which has more memory load using genetic algorithm. This process continues until the list of tasks from users become empty.

V. RESULTS AND DISCUSSIONS

A. Completion Time

1) The number of instructions the processor can execute per second:

$$TQ=(NP * MIPS)/1000 \quad (1)$$

whereas, TQ - Time Quantum, NP - Number of Processors, MIPS - Million Instructions Per Second,

2) Average Time of Tasks is calculated using,

$$TQ=\sum TN / NT \quad (2)$$

Whereas, TQ - Time Quantum, TN - Time needed for executing a specific task(Burst Time), NT - Number of Tasks.

3) The time can be calculated as sum of execution time of all tasks assigned to the VM ,VTi

$$VTi = \sum_{j=0}^{m} CTji * E(j,i) \quad (3)$$

The meaning of each symbol in the formula is as follows,

a) i represents the sequence of number of a VM with the scope of[0-n].

b) j Є [0-m]represents the sequence number of a cloudlet.

c) CTji is the time cloudlet j consumes when running in the VM i calculated by CTji= ETji + (CIS+COS) / Bwji. It consists of two parts: execution time in the choosing VMj and data transfer time which are decided by input and output size of the task file and the network bandwidth of the VM.

d) E(i,j)=1, when cloudlet j is assigned to VM i; Otherwise, E(j,i)=0.

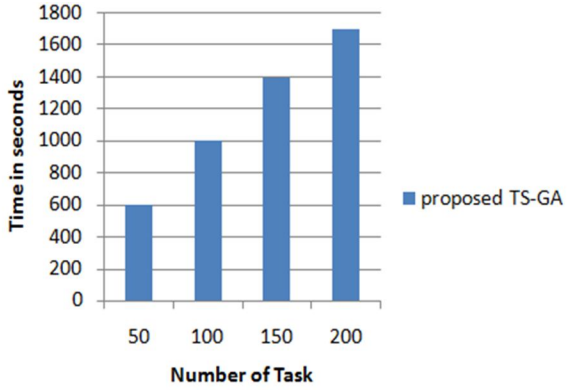

Fig.2.Graph for Completion Time

2) Execution Cost: The total cost for executing all the tasks in available virtual machines can be calculated as,

$$\text{Total cost} = Processing\ cost + \frac{TL * CPS}{VM} \quad (4)$$

whereas, TL - Task Length, CPS - Cost Per Second.

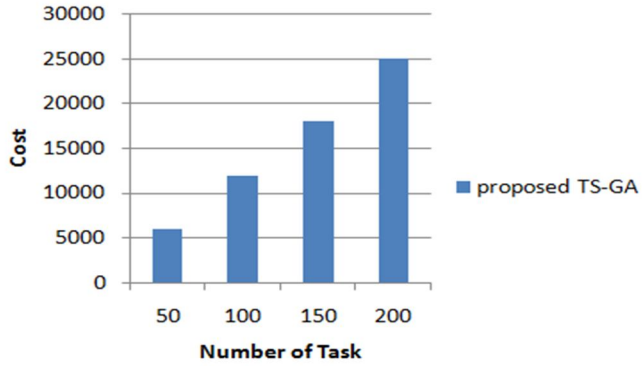

Fig.3.Graph for Execution Cost

3) Resource Utilization: Utilization of resource can be calculated as follows,

$$U = 100 * \frac{final\ vms\ available\ time}{\#VMs * Scheduling\ time} \quad (5)$$

whereas, U - Utilization.

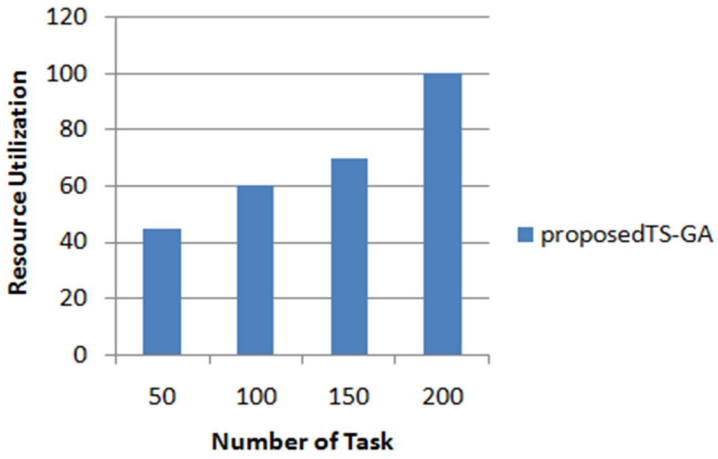

Fig.4.Graph for Resource Utilization

4) Speedup and Efficiency:

$$Speedup = \frac{F}{schedule\ time} \quad (6)$$

whereas, F - Final sum of execute time of tasks to one VM / #VMs.

$$\text{Efficiency} = \frac{\text{Speedup}}{\#VMs} \quad (7)$$

VI. CONCLUSION AND FUTURE ENHANCEMENT

Task Scheduling is one of the main obstacle in cloud computing. Task Scheduling is used to make better use of the resources available in the cloud. Here, we have discussed about three algorithms Min-Max, Max-Min and Genetic algorithm.In this paper we have sincerely attempted to minimize the makespan of algorithm by Max Min algorithm for initializing population in genetic algorithm. Compared to other algorithms efficient genetic algorithm is used to minimize the makespan. For future enhancement the fitness criteria can be calculated using execution cost of the resource

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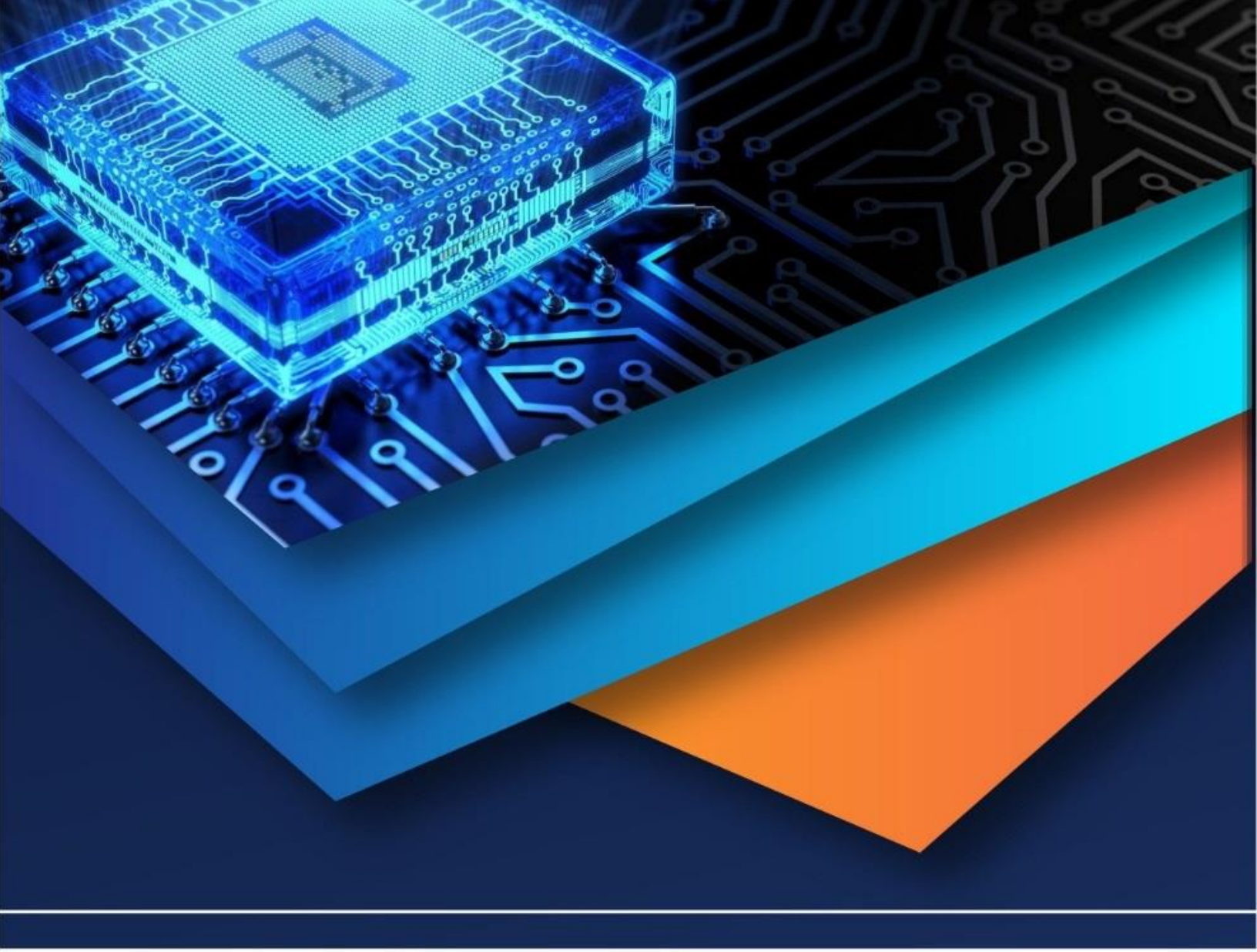

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