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Comparative Study of Various Scheduling Algorithms in Cloud Computing

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***Abstract*—** Cloud computing is an emerging technology and serves as next generation platform, which allows the user to pay as they use. It permits access to remote and geographically distributed resources with the help of an important feature in cloud computing called virtualization. Cloud consists of number of virtual machines. In cloud there is need of number of virtual machines (VM) based on the requirement of user and cloud service providers. Scheduling is necessary to manage large number of VM requests. Scheduling is key technology in cloud computing, scheduling of tasks and resource allocation is challenging task in cloud. So we require scheduling algorithm. Primary consideration of scheduling algorithm is to provide proficiency to task and resource scheduling. Main objective of the paper is to give comparative analysis of existing scheduling algorithm in cloud platform where resources have varying cost and computational efficiency. In this paper we have surveyed on different types of scheduling algorithm and tabulated their various parameters, scheduling factors and so on.

***Keywords*—** Cloud computing, Scheduling, Scheduling algorithm, Resource allocation,virtual machines.

I. INTRODUCTION

A cloud is a type of parallel and distributed system which consists of collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements that is established through negotiation between service provider and consumers. According to the requirements and preferences of users computing resources are allocated dynamically. computing resources are shared among users based on pay as use policy as per the customer's requirements. There is significant impact of resource allocation and proper scheduling on performance of system. scheduling plays very important role in determining the effective execution. An efficient scheduling, provisioning, load balancing and security aware infrastructure needed to manage access to different locations. various scheduling algorithms are available in this paper few of the algorithms are compared and tabulated their values.

II. SCHEDULING IN CLOUD

An essential requirement in cloud computing environment is scheduling the current jobs to be executed with the given constraints. Cloud Computing is also about how IT is provisioned and used and not only about technological improvements and also the scheduling of data centers. The main target of scheduling is to maximize the resource utilization and minimize processing time of the tasks. The scheduler should order the jobs in a way where balance between improving the quality of services and at the same time maintaining the efficiency and fairness among the jobs. An efficient job scheduling strategy must aim to yield less response time. so that the execution of submitted jobs takes place within a stipulated time and simultaneously there will be an occurrence of in- time resource reallocation. As a result of this, jobs takes place and more number of jobs can be submitted to the cloud by the clients which ultimately results in accelerating the business performance of the cloud system.

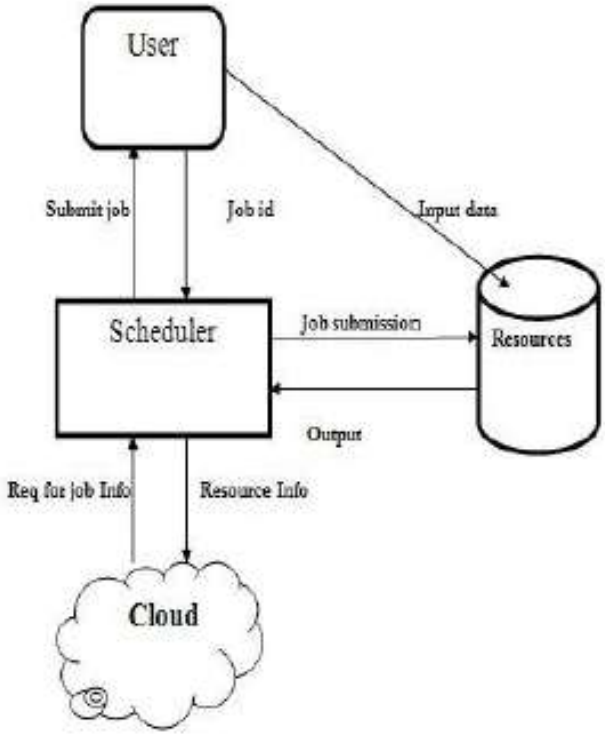

Fig.1 scheduling in cloud environment

III. PROCEDURE OF SCHEDULING

In cloud computing scheduling is done in three stages

1. Discovering a resource and filtering them.
2. Selecting a target resource(decision stage).
3. Submission of particular task to a target resource.

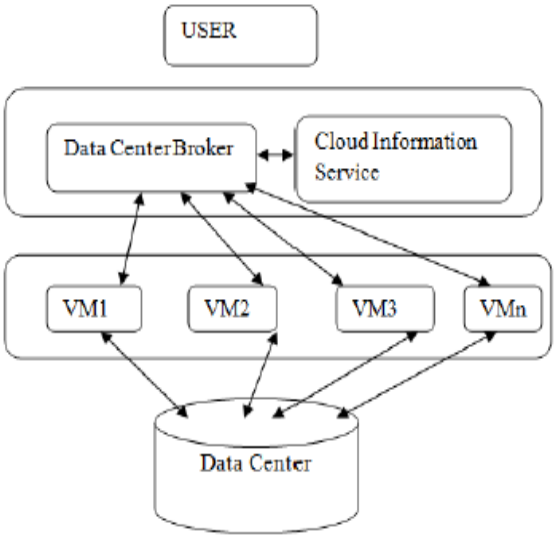

Fig.2 job scheduling in cloud environment

There are many algorithms for scheduling in cloud computing, to obtain high performance is the main advantage of scheduling algorithm. In this paper we will discuss about five scheduling algorithms they are First Come First Serve (FCFS), Round Robin (RR), Genetic algorithm, Match-making algorithm and Generalized priority algorithm. Compare them and obtain the results.

IV. LITERATURE SURVEY

A. First come first serve(FCFS) Algorithm

FCFS is mainly used for parallel processing, it is selected for incoming task and it is aimed at resource with smallest waiting queue time. The CloudSim toolkit supports FCFS scheduling strategy for internal scheduling of jobs. Allocation of application-specific VMs to host in a cloud based data center is the responsibility of the virtual machine provisioned component. The default policy of implemented by VM provisioning is straightforward policy that allocates a VM to the host in FCFS basis. The disadvantage of FCFS is it is non-preemptive algorithm. The shortest task which are at the back of the queue have to wait for the long task at the front finish. Its turn around and response time is low.

B. Round Robin (RR) Algorithm

The Round Robin algorithm focuses on fairness and on distributing the load equally to all nodes. Each job in a queue has same execution time and it will be executed in turn. The scheduler starts assigning VM to each node and move further for next VM to place in next node. algorithm is applied for all the nodes until one VM is assigned to each node. again it goes to the first node repeat this process to the next VM request.

The advantage is that it utilizes all the resources in the balanced order.Disadvantage is high power consumption as many nodes are turned on. If four resources has to be run on a single node, all the nodes will be turned on when Round Robin is used. This consumes high power. supports RRCloudSim toolkit supports RR scheduling strategy for internal scheduling of jobs.CloudSim toolkit supports RR scheduling strategy for internal scheduling of jobs.

C. Genetic Algorithm

Genetic algorithms are stochastic search algorithms based on the mechanism of natural selection strategy. It starts with a set of initial solution, called initial population, and will generate new solution using genetic operators. The genetic algorithm approach computes the impact in advance, that it will have on the system after the new VM resource is deployed in the system, by utilizing historical data and current state of the system. It then picks up the solution, which will have the least effect on the system.

The advantage of this technique is it can handle a large searching space, applicable to complex objective function and can avoid trapping by local optimum solution. Authors of [11] have developed a cost-based job scheduling algorithm, which provide a multi QoS scheduling in cloud computing environment.

D. Match-Making Algorithm

The algorithm first filter out the nodes or hosts those do not meet the VM requirements and do not have enough resources (Like CPU, Memory, Processors etc) to place and run the VM. Rank will be given to nodes as per the gathered information by the monitoring drivers. If any variable comes in monitoring then it will be included in to rank expression . The result of rank expression is given to the cloud scheduler and monitoring driver makes decision for VMs placement and reconfiguration. OpenNebula has default match making scheduler that implements the Rank scheduling policy. OpenNebula comes with Haizea Scheduler that support advance reservation of resources and queuing of best effort requests . The goal of this algorithm is to prioritize resources those are most suitable for the VM. Those resources with a higher rank are used first to allocate VMs.

E. Generalized Priority Algorithm

Customer define the priority according to the user demand you have to define the parameter of cloudlet like size, memory, bandwidth scheduling policy etc.

In the proposed strategy, the tasks are initially prioritized according to their size such that one having highest size has highest rank. The Virtual Machines are also ranked (prioritized) according to their MIPS value such that the one

having highest MIPS has the highest rank. Thus, the key factor for prioritizing tasks is their size and for VM is their MIPS. This policy is performing better than FCFS and Round Robin scheduling

TABLE I: COMPARISION OF ALGORITHMS BASED ON SCHEDULING CRITERIA

Scheduling Algorithms	Open source	Cloud Service Providers
Round Robin	✓	Eucalyptus Rackspace Lunacloud
Greedy First Fit	✓	Eucalyptus
Rank Matchmaker scheduling	✓	Open Nebula
Pre-emption scheduling	✓	
Least connection	✓	Rackspace
VM schedulers PBS and SGE	✓	Nimbus
Xen	-	Amazon EC2
Swam	-	
Genetic	-	

TABLE III: COMPARISION BASED ON PERFORMANCE

V. COMPARISION OF ALGORITHMS

Determination of best scheduling algorithm for cloud computing depends on various factors. For scheduling and provisioning of resources different algorithms are available that are aware of particular factor. On the basis of above study various selected factors have been identified to classify the algorithms. We have comparison of such algorithms with factors like scheduling factorsTime, Power, Cost, Security and Memory. shown in table I and II.

Algorithm	Environment	Scheduling factor	Objective criteria	Advantages	disadvantages
First Come First Serve	Cloud / Grid Computing	Time	Energy efficiency	Fair and easy to implement	Non-pre-emptive algorithm
Round Robin	Cloud Computing	Time	Response time	Utilization of all resources in balanced order, ensures fairness	High power consumption
Genetic Algorithm	Cloud Computing	Cost	Makespan	Handle large search space, applicable to complex objective function	Migration cost
Match-Making Algorithm	Cloud Computing	Energy consumption	Rank scheduling policy	Good distribution of work load into resources	Lack of availability and reliability
Generalized Priority Algorithm	Cloud Computing	cost	Resource allocation	Better than FCFS and RR	High power consumption

Algorithm	Time	cost	performance	Throughput	Response time	Resource utilization
First Come First Serve	-	-	-	✓	-	✓
Round Robin	✓	-	✓	✓	✓	✓
Genetic Algorithm	-	✓	✓	✓	✓	✓
Match-Making Algorithm	-	✓	-	-	-	✓
Generalized Priority Algorithm	-	-	✓	✓	✓	✓

based on the customer or service provider requirements various algorithms can be used for enhancing the efficiency and also to get optimized resource allocation and load balancing depending on various factors. the scheduling algorithms used by various cloud service provider(CSP) is shown in table 3.

TABLE IIIII

SCHEDULING ALGORITHMS USED BY DIFFERENT CLOUD SERVICE PROVIDERS

VI. CONCLUSION

In Cloud computing environment heterogeneous resources are provided as services with the help of Virtual Machines, Those resources should be managed in optimized way with efficient scheduling. Scheduling is one of the most important task in Cloud environment. In this paper various scheduling algorithms of cloud environment based on distinguishable scheduling parameters like Scheduling factors, Objective criteria, resource utilization, response time, time, cost and performance have been compared and analyzed.Different scheduling algorithms works on different scheduling criteria all algorithms are efficient in one or the other way.

There are also drawbacks in every scheduling algorithm, existing scheduling algorithms gives high throughput and cost effective but they do not consider reliability and availability,none of them achieves 100% efficiency, there is lack of security aware scheduling and provisioning algorithms. There is a need of new scheduling algorithm which takes factors like security, reliability and availability in to account .

VII. FUTURE WORK

Future enhancement will propose a new algorithm for resource scheduling which takes into account security reliability availability issues to attain maximum efficiency and proficiency and enhance profits to cloud service providers.

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