Analysis of Task Scheduling Algorithms using Cloud Computing

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Abstract—**Cloud Computing refers to computing services over the internet and deals with varied different virtualization resources. The task scheduling play a crucial role to enhance the performance of cloud computing. The issue with task scheduling is distribution of tasks within the system in a manner that will optimize the performance of overall system and minimize the makespan. The optimal scheduling of tasks requires the minimum cost, makespan, maximize throughput and minimum turnaround time. The comparison and analysis of different task scheduling algorithms has been discussed in this paper on the basis of different parameters such as makespan, waiting time, cost etc.**

Index Terms— **Cloud Computing, Service models, Task scheduling, Scheduling algorithms.**

I. INTRODUCTION

Cloud computing provides a shared pool of various resources including data storage space, networks, computer processing power, and user applications. The cloud computing is a combination of technologies where a large number of systems are connected in private or public networks[1]. The cloud services consist of highly optimized virtual datacenter and provide various hardware, software and information resources for use. Organizations simply connect with the cloud and use the available resources on the pay-per use basis. The cloud provides on-demand network access to a shared pool of configurable computing resources that can be rapidly distributed and released with minimal management effort or service provider interaction. It is a significant evolution in the delivery of information technology and services. The aim of cloud computing environment is to optimally use the available computing resources[15]. Virtualization greatly helps in valuable utilization of resources and build an effective system. Customers use cloud computing in the form of services like Gmail, Face book, YouTube, Yahoo, Hotmail etc. Due to the wide range of facilities provided by the cloud computing, the Cloud Computing is becoming the need of the IT industries. A cloud consist of several data centers, servers, clients which are interconnected in an efficient way. It includes fault tolerance, high availability, scalability, flexibility, reduced overhead for users, reduced cost of ownership, on demand services etc.

The services of the Cloud are provided through the Internet. Cloud provides the three types of service models that are software as service(SaaS), platform as service(PaaS) and infrastructure as service(IaaS).

SaaS model allow to use software application as the service to end user for e.g. Gmail, facebook etc. PaaS model provides the facility to creation of web application easily for e.g. azure service platform, Google App Engine etc. IaaS provides basic storage and computing capabilities as standardized services over the network for e.g.Amazon, GoGrid, Rackspace Open Cloud, etc. Scheduling is the vital task in cloud computing environment. Scheduling means the set of rules and mechanisms for controlling the order of work to be performed by computing systems. There are numerous types of scheduling algorithms and task scheduling being the significant one. In cloud task scheduling is the major problem.The scheduling of tasks means an optimal usage of available resources. The main purpose of scheduling is to achieve the high performance, reduce the waiting time, increase system throughput and so on. Task scheduling is a challenging issue in cloud computing because it is parallel and distributed architecture. The task completion time determination is difficult in cloud because the tasks may be distributed between more than one Virtual machine. Virtual CPUs are assigned to each virtual machine. An effective task scheduling method requires not only meeting the user's needs but also improve the performance of the whole system.
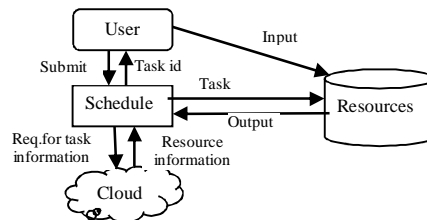

Fig.1: Process of scheduling

II. LITERATURE SURVEY

Various journal and conference papers have been extensively studied and reviewed for this work and are as follows:

Thomas et al.[15] presented scheduling as major task in a cloud computing environment. In Cloud computing environment datacenters take care of this task. The scheduling algorithm has been analyzed which were based on user priority and task length. The three cloud scheduling scenarios has been discussed. First scenario is based on the length of tasks. The second scenario is based on task priority. The third and the proposed approach works on both cloudlet priority and cloudlet length. Sindhu and Mukherjee [2] described that cloud Computing refers to the use of computing, platform, software, as a service. Computing resources are delivered as virtual machines. In such a scenario, task scheduling algorithms play an important role where the aim is to schedule the tasks effectively so as to reduce the turnaround time and improve resource utilization. The work presented two scheduling algorithms for scheduling tasks taking into consideration their computational complexity and computing capacity of processing elements while making scheduling decisions.

Al-Maamari and Omara [6] discussed that task scheduling is the most significant matter in the cloud computing because the user has to pay for resource using on the basis of time, which acts to distribute the load evenly among the system resources by maximizing utilization and reducing task execution Time. The work implemented a Dynamic Adaptive Particle Swarm Optimization algorithm (DAPSO) to enhance the performance of the basic PSO algorithm to optimize the task runtime by minimizing the makespan of a particular task set, and in the same time, maximizing resource utilization. Also a task scheduling algorithm has been proposed to schedule the independent task over the Cloud Computing. Mandal and Acharyya [20] explained that task scheduling issue is mainly focus on to find the best or optimal resources in order to minimize the total processing time of Virtual Machines (VMs).The focus is on increasing the efficient use of the shared resources. The work three meta-heuristic techniques such as Simulated Annealing, Firefly Algorithm and Cuckoo Search Algorithm have been implemented to find an optimal solution. The study of these algorithms is to minimize the overall processing time of the VMs which execute a set of tasks.

Mehranzadeh and Hashemi [18] presented cloud computing one host as component that represents a physical computing and a datacenter is composed by a set of hosts, which are responsible for managing Virtual Machines during their life cycles. An important issue in cloud computing is the scheduling of virtual machines requests so that the requested tasks can be completed in a minimum time according to the user

defined time and compared various scheduling techniques First come first serve (FCFS) and Round Robin (RR).Sun et al.[11] presented priority-based task scheduling algorithm (P-TSA) in grid. In this kind of priority-based algorithm, tasks are scheduled according to the priority order firstly. And then assign processors. The work Comparing P-TSA with existed grid scheduling algorithms on scheduling length and resource utilization rates. The performance of P-TSA is better than other scheduling algorithms such as Min-min and Max-min.

Li et al. [1] described that cloud computing is the development of distributed computing, parallel computing and grid computing, or defined as the commercial implementation of these computer science concepts. A good task scheduler should adapt its scheduling strategy to the changing environment and the types of tasks. One of the fundamental issues in this environment is related to task scheduling. Cloud task scheduling is an NP-hard optimization problem The paper proposed a cloud task scheduling policy based on Load Balancing Ant Colony Optimization (LBACO).Vijayalakshmi et al.[8] described that allocating the resources efficiently is a challenging job. Service providers need to ensure that their resources are utilized properly. The new scheduling algorithm in this make an address the challenge of task scheduling in cloud. The user tasks are prioritized. Based on the priority, the tasks are assigned to the Virtual Machines. The task with highest priority is assigned to a Virtual Machine with highest processing power and minimize the execution time.

Mohapatra et al.[17] discussed to properly manage the resources of the service provider requires balancing the load of the jobs that are submitted to the service provider. The comparison of different variants of RR for load balancing and each algorithm is observed and their scheduling criteria like average response time, data center service time and total cost of different data centers are found. Elzeki et.al [19] highlighted the cloud computing is a recent advancement wherein IT infrastructure and applications are provided as services to end users under a usage based payment model The work selection of jobs to be scheduled based on FCFS, SJF, priority based, coarse grained task grouping etc and selected job to be executed and the corresponding resources where the job are executed.

III. EXISTING TASK SCHEDULING ALGORITHMS

1. **Min –Min scheduling algorithm**: Min-Min algorithm starts with a set of tasks which is unassigned. It computes minimum completion time for tasks on all resources and minimum time and minimum value is selected .In this algorithm tasks having the minimum length is executed first. Some advantages of this algorithm are Simple, fast and minimum completion time because it select the minimum length of tasks and execute and a disadvantage is small tasks assigning first because it does not consider priority of tasks and sometimes it cannot execute the maximum length of tasks.

2. **Max-Min scheduling algorithm**: Max –Min is almost same as the min-min algorithms except this after finding out the completion time the minimum execution time are found out for every task. Then among these minimum times the maximum value is selected. In this algorithm task having the maximum length executed first. Advantage of Max-Min algorithm is Minimum completion time and a disadvantage is Poor load balancing because it executes the maximum length of tasks first and sometimes it takes too much time for execution.

3. **First come first served scheduling algorithm:** First-Come-First-Served algorithm is the simplest scheduling algorithm .The task requests first will be execute first. It is a non-preemptive scheduling algorithm. FCFS used for the parallel processing. The waiting time of all tasks is larger. Advantages of FCFS are Simple, Fair because it easy to implement and disadvantages of FCFS are that short task takes long duration of time. The shortest tasks have to wait at the back of the queue until long task at the front of the queue is finished.

4. **Shortest Job first (SJF) Scheduling algorithm:** The Shortest job First (SJF) scheduling is like FCFS except that instead of choosing the job at the front of the queue it will always choose the shortest job available i.e. scheduled the job first which is shortest duration time. Processer should know in advance how much time process/task will take. If the cpu required time not known it is impossible to implement. Advantage of SJF is that minimize average waiting time and disadvantage is that difficult to predict burst time

5. **Ant Colony Optimization:** The ant colony optimization algorithm is a distributed algorithm that is used to solve combinational optimization problems. In the ACO algorithm, the load is calculated on each host taking into account the CPU utilization made by all the VMs that are executing on each host. It is a meta-

heuristic method of scheduling, Advantages of ACO algorithm that it improves efficiency and reliability and disadvantages of ACO are Complexity and long time consumption

6. **Round Robin scheduling algorithm:** Round Robin uses the queue to store jobs. Each job in a queue has the same performance time and it will be executed in turn. The advantage of RR algorithm is that each job will be executed in chance and they don't have to be waited for the previous one to get finished. Round Robin is the preemptive process scheduling algorithm. Advantages of Round Robin are Low waiting time, preemptive scheduling algorithm and disadvantages are Performance depends length on time slice.

7. **Priority based scheduling algorithm:** Each task is assigned a priority. Tasks with the highest priority are to be executed first and so on. Priority of tasks can be decided on memory requirement time requirement or any other resource requirement. It provides the good response time to the tasks. Advantages are Simple, suitable for time and cost and disadvantage are Indefinite blocking and starvation leave some low priority waiting processes indefinite for cpu.

IV. COMPARISON OF TASK SCHEDULING ALGORITHMS

In this section compare and analyzed the task scheduling algorithms. The table I below highlighted the different scheduling algorithms with their parameters and objectives.

TABLE I: COMPARISON OF TASK SCHEDULING ALGORITHM

S. No	Scheduling Algorithms/ Purposed by Author	Scheduling Parameters	Objectives
1.	FCFS/ Awada et.al[5]	Deadline,cost,complition time	Optimized memory usage and enhances system performance.
2.	Shortest Job scheduling/ Sindhu et.al [2]	Arrival time, process time, deadline and I/O requirement	Effective resource allocation under defined parameters
3.	Priority based job Scheduling / Ghanbaria et.al[13]	Cost, Finish time	Assigned priority, based on priority processes are allowed to be executed.
4.	Ant Colony Optimization/ zuo et.al[16]	Makespan, cost,deadline	Optimize the scheduling of performance and user cost.
5.	Min-Min/ Patel et.al[7]	Makespan, resource utilization	Tasks with minimum length are executed
6.	Max-Min algorithm/ Elzeki et.al[19]	Expected completion time,Makespan	Tasks with maximum length are executed.
7.	Round Robin Algorithm/ Mohapatra et.al[17]	Turnaround time, waiting time	Less complexity and load is balanced more fairly

In above table the different scheduling algorithms have been discussed with their parameters. In FCFS the incoming tasks are classified on the basis of task requirement like minimum execution time or minimum cost and prioritized FCFS manner to enhance the system performance. The Shortest job first includes the process time, arrival time scheduling parameters for effective resource allocation. In the priority based job scheduling algorithm the cost and finish time of jobs have been discussed. In this algorithm the jobs are selected for execution on the basis of priority. In Ant colony optimization(ACO) the makespan, cost, and deadline of tasks are discussed and optimized the performance and user cost of the system. The Min-Min and Max-Min scheduling algorithms including the makespan ,resource utilization and expected completion time and executed the tasks according to their length. In Round Robin scheduling algorithm the turnaround time, waiting time have been discussed. In this each task is executed on particular time which also called a time slicing.

V. CONCLUSIONS

Cloud computing is an approach of computing utilities that provides a lot of flexibility, less expense, and more efficiency in IT services to end users. The task scheduling is challenging issue in cloud computing. Efficient scheduling algorithms continually plays an essential role in the performance of systems. The

existing task scheduling algorithms have been reviewed and comparison of all the different scheduling parameters which are used in the scheduling algorithms are discussed. Traditional strategies of scheduling lead to high compilation time and low throughput. The proposed algorithms make use of round robin in addition to priority and it will simply meet all of the demanding situations.

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