A Technical Survey on Task Scheduling in Cloud Computing Environment

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ABSTRACT - *Cloud Computing is a computing environment where different services are provided to the users over the Web. Task Scheduling is one of the major aspects of Cloud Computing, improving the performance of the cloud system. Task Scheduling involves assignment of resources to a particular task to be completed within possible minimum completion time. It is very important to apply appropriate scheduling technique to process a large set of data and to do resource utilization more efficiently with better performance. In this paper, we present a survey of various task scheduling algorithms in Cloud Computing. Resources are efficiently allocated to reducethe execution time and cost.*

Keywords - *Task scheduling, Load Balancing, Cloud Computing, Makespan, Cloud Scheduling.*

1. INTRODUCTION

Maintaining rapid development of applications is an important aspect in the information technology sector and minimizing the time and effort spent on software deployment. It is an upcoming trend widely used for the purpose of storage, memory sharing, computational capacity sharing, and sharing of hardware resources over a network like the internet. Provides resources for both individuals and organizations as a service that can be used at any time or place of the user's request and convenience. This leads to time and cost saving for users because they don't necessarily need to have the resources they need and can use the service at their own will.

1.1 CLOUD MODELS:

There are three types of models present in cloud computing which are given as follows:

Public Cloud Model: The public cloud model is defined as a cloud infrastructure which is managed by an organization providing third-party service. This is available as a service over the internet for both individual users and software companies/ organizations. This model's main advantage is that it is very large in scale. With limited configurations and security protection, the users in this model share the same infrastructure pool as provided by the service provider.

Private Cloud Model: The private cloud model is defined as a cloud computing infrastructure exclusively developed by a given company for each project or software. This requires a policy of permission to host cloud applications to enforce system security and control. In addition to being generated for each specific project, an external party or supplier also provide the cloud service.

Hybrid Cloud Model: The hybrid cloud model is defined as a cloud computing infrastructure that combines both public and private cloud models' advantageous factors. This is done using separate algorithms used to switch between the two infrastructures.

1.2 CLOUD COMPUTING MODELS

Infrastructure as a service (IaaS) allows users to use their storage or computational units remotely to access the given network. It does soon a demand-based basis whenever the service is required by the user. E.g: Microsoft Azure, Amazon Web Service.

Platform as a Service (PaaS) enables users to quickly and easily create web applications with permissions to provide a substitute for the purchase and maintenance of the system's software and infrastructure. Eg: Google App Engine.

Software as a service (SaaS) enables users to obtain an application license for any user, either as an on-demand service or through Internet subscription. In a simple way, it can be rented for use in a pay-as-you-go way instead of buying the required software. Example: Sales force, Cisco WebEx.

1.3. CLOUD COMPUTING TOOLS

Cloud services across a network are used as efficient, organizational-based business solutions. Various cloud computing tools, such as Eucalyptus, Open Nebula, Nimbus, Open stack, ete., are available where they all have different deployment strategies.

Cloud computing load balancing is defined as the process of distributing workload and computing resources within a networked cloud computing environment. It enables an organization to manage applications or workload demands on a task-by-task basis, by allocating resources on the networks between the various computers or through servers.

1.3 TASK SCHEDULING

This is a process that takes place while the virtual machines are using a restricted task based on the operation to be performed. The scheduler collects the data from the Request Manager or Server and Resource and then calculates it to make a decision that assigns each task to their respective virtual machine.

2. LITERATURE SURVEY

Jun Nie[1],studies the task scheduling in cloud computing, analyzes the programming model framework of cloud computing, and presents a hybrid scheduling algorithm based on ant colony algorithm and genetic algorithm. This algorithm makes full use of the rapid random global search ability of the genetic algorithm ,In addition it overcome the problem of the initial pheromone lacking in the ant colony algorithm resulting in slow solution. The simulation result shows that this algorithm has good performance and improves the efficiency of task scheduling in cloud computing environment. It is an efficient task scheduling algorithm in cloud computing environment.

Fakhrosadat Fanian,Vahid Khatibi Bardsiri and Mohammad Shokouhifar[2], presented the study which aims at presents a new cloud job scheduling algorithm using both the firefly annealing and simulated annealing algorithms. This algorithm conqiuremerits of both firefly annealing and simulated annealing algorithms. In addition to this, efforts had been made to alter the primary solution or primary population for the firefly algorithm. This algorithm uses a better primary solution, local search was another aspect considered for the new algorithm. It was compared and evaluated against common algorithms. As indicated by the results, compared to other algorithms, the presented algorithm performs effeciently better in reducing to make span using various number of tasks and virtual machines.

PeiYun Zhang[3],presents a technique based on a two-stage strategy to increase task scheduling performance and decrease non reasonable task allocation in clouds. At the first step, a task classifier based on a Bayes classifier's principle is used to classify the tasks based on the historic scheduling data's. A definite number of virtual machines (VMs) of the various types are accordingly created. It saves the time of creating VMs during task scheduling. At the second step, the tasks are coordinated with the abstract VMs dynamically. Dynamic task scheduling algorithms are proposed accordingly. An experimental result shows that this algorithm can effectively maximize the cloud's scheduling performance and accomplish the load balancing of cloud resources in comparison to the existing methods.

Mahendra Bhatu Gawali and Subhash K. Shinde[4], presents a heuristic approach that combine the modified analytic hierarchy process (MAHP), longest expected processing time preemption (LEPT), bandwidth aware isolatable scheduling (BATS) + BAR optimization, and split and overcome methods to perform task scheduling and resource allocation. In this approach, every task is processed before than its actual allocation to cloud resources by makes use of a MAHP process. The combined BAR and BATS optimization method is utilized to allocate the resources, which considers the bandwidth and the cloud resources load as constraints. In addition, presented system pre-empts resource intensive tasks by makes use of LEPT preemption. Divide and conquer technique is used to improve the performance of the proposed system. It was experimentally proved through comparison with the IDEA and Band with Aware Divisible Scheduling algorithm, where response time and turnaround time are used as performance metrics.

Yang Liu, Wanneng Shu and Chrish Zhang[5],proposes an energy consumption optimization model for task scheduling, and proposes a green clonal scheduling optimization algorithm by taking merits of the clonal operator of immune algorithm. Experimental result shows that the presented algorithm not only effectively minimize the execution time and energy consumption, and also can accomplish resource load balancing, thus effeciently maximize the resource utilization and task scheduling efficiency.

Arabi E. Keshk[6],presents an online cloud task scheduling according to virtual machine adaptive fault tolerance and job load balancing using ant colony algorithm. The main contribution of this work is that load balancing factor is included to the system to tolerate the faults by making the decision on the basis of reliableness of the virtual machines in scheduling process. Experimental results conclude that the presented algorithm achieve better load balance in comparison to the Join-shortest-queue and Modified Ant Colony Optimization algorithms.

Tao Yu,Xiaofei Liu,Honggang Zhang, Hongyan Cui,Zongguo Xia and Yajun Fang[7],presents a Task Scheduling System (TSS). In the user subsystem, the process time of each and every task is distributed with the general distribution. In the task scheduling model, it takes a weighted sum of flow time and make span as a objective function and use a Genetic Algorithm (GA) and Ant Colony Optimization (ACO) to solve the cloud task scheduling problem. Experiment result conclude that the convergence speed and output performance of proposed Genetic Algorithm-Chaos Ant Colony Optimization (GA-CACO) algorithm is optimal.

Sobhanayak Srichandan[8],explores the task scheduling algorithm based on hybrid approach, which combines wanted characteristics of two of the most commonly used heuristic algorithms such as genetic algorithms and bacterial foraging in the cloud scheduling. The major contribution of this study is twofold. First to reduce the make span and second one is to minimize the energy consumption, both cost and ecological perspectives. Simulation results conclude that the performance of the presented algorithm Is much better than those of other algorithms regarding stability, convergence, and solution diversity.

Safwat A. Hamad and Fatma A. Omara[9], discovers a load balancing technique based on Genetic Algorithm (GA) for assigning resources and executing an application's jobs. The major objective of this presented technique is to reduce the cost and completion time of the jobs, and increase resource utilization.

Ruba abu khurma, Heba al harahsheh and Ahmad sharieh[10], presents a review study of a variety of work preparation algorithms in cloud surroundings such as: MaxMin,RR, FCFS, MinMin, MCT, GA , and PSO, along with a case study on the modified round robin (MRR) algorithm. The experiment results concluded that the average waiting of run time becomes lesser by using the MRR algorithm to assign a number of Cloudlets to a number of VMs, than using the RR in the same system. Thus, it is advised to use the proposed MRR for job scheduling in cloud computing, because it minimize the average waiting time and support the great features of the RR such as avoiding starvation, fairness, based on simpler rule, dynamic based on cloud computing environment situations, and adoptable for load balancing.

J.Kok Konjaang Fahrul Hakim Ayob and Abdullah Muhammed[11],proposed a new noble mechanism called Modified Max-Min (MMax-Min) algorithm, inspired from Max-Min algorithm. The recent algorithm find out a cloudlet with uppermost conclusion time and lowest completion time and assign either of the cloudlets for implementation in accordance to the stipulation for the purpose of boosting up cloud scheduling processes and to increase throughput. The simulation results show that the proposed approach has the ablity to produce good degree solution, gives us better values of make span and load balancing effectively in compared with standard Max-Min, and Round Robin algorithms.

Pradeep Krishnadoss and Prem Jacob[12],merged two algorithms namely, oppositional based learning (OBL) and cuckoo search algorithm (CSA)and produced a hybrid algorithm called oppositional cuckoo search algorithm (OCSA).The proposed algorithm shows noticeable improvement over the other task scheduling algorithms.The results of simulation show the effeciency of the presented work by reducing cost and makespan parameters. The obtained results is better in comparison to other existing algorithms like Improved Differential Evolution Algorithm (IDEA) , particle swarm optimization (PSO)and genetic algorithm(GA).

Pooja and Dr Sanjay Tyagi[13],proposes Multi Queue (MQ) scheduling algorithm to increase the performance of the system. This scheduling algorithm overcome the drawback of existing Round Robin and Weighted Round Robin algorithms. Simulation results of Multi Queue (MQ) scheduling algorithm shows that it has better performance than the Weighted Round Robin (WRR)algorithms and exiting Round Robin (RR).

Rohit Nagar,Deepak K. Gupta and Raj M. Singh[14],proposed a new PEFT genetic algorithm approach to further decrease the execution time on PEFT algorithm. This technique is developed to enable GA concentrate on to optimize chromosomes goals to get bttersuitable mutated children. After getting a feasible solution, the genetic algorithm concentrates on optimize the execution time. Experimental results show that the proposed algorithm can find better solution within lesser time.

Nuzhat Fatima, Anugrah and Samendra[15],proposes hybrid algorithm that is a combination of Throttled and Current Execution algorithms that equally spread.The Proposed algorithm overcomes the drawbacks of throttled and equally spread current execution algorithm. The proposed algorithm maintains an index table of VMs and the state of VM will be either BUSY or FREE.

Er.Mandeep Kaur and Parveen Kumar [16],presents a Load Balancing technique based on the Enhanced Genetic (EGA) algorithm. The main goal of this work is to balance the load of the entire system while trying to minimize the make span and cost of a given tasks set. Simulation results showed the proposed Enhanced Genetic (EGA) algorithm outperformed FCFS (First Come First Serve) and Compare the ACO, EGA.

James Kok Konjaang, Fahrul Hakim Ayob and Abdullah Muhammed[17],proposed a new mechanism call Expanded Max-Min (Expa-Max-Min) algorithm to effectively give equal possibility to both cloudlets with minimum and maximum execution time to be scheduled in a reduce time and cost. Presented algorithm firstly computes the completion time of all the cloudlets in cloudlet List to identify the cloudlets with largest and smallestexecution time, and then it aligns and queue the cloudlets intotwo queues according to their execution time. The presented Expa-Max-Min algorithm select a cloudlet from the cloudlet List with the largestexecution time queue and alloting it to a resource that has thesmallestcompletion time, In other hand executing cloudlets in the lowestexecution time queue at the similar time. The simulation results conclude that the presented Expa-Max-Min algorithm, is capable to produce better quality solutions in terms of reducing makespan and average cost and capable to balance loads than Max-Min and Min-Min algorithms.

Pradeep Krishnadoss and Prem Jacob[18],proposed OLOA, a solution is provided for optimization, taking the makespan and cost as a major constraints.This is established using the two algorithms,OppositionBased Learning algorithm and Lion optimization algorithm: and discovers a hybrid Oppositional Lion optimization algorithm (OLOA). The experiment results conclude that drastic enhancement in performance, in comparison

with the previously used other existent techniques such as Particle Swarm Optimization (PSO) algorithm, and Genetic algorithm (GA) oppositional learning based grey wolf optimizer (OGWO) , all of which do not match the performance rate of the proposed hybrid algorithm.

Majid Habibi and Nima Jafari Navimipour[19],presents a meta-heuristic method based on ICA to optimize the scheduling issue in the cloud environment. Simulation result in the MATLAB environment shows the amount of 0.7 percent improvement in execution time in comparision with a Genetic Algorithm(GA).One of the major disadvantage of the ICA is its quick convergence to the local optimum points. To solve this problem and increase the scanning ability of algorithm, a process similar to fixed mixing process which is used in GAs is used in the policy of absorption.

Saher Manaseer, Metib Alzghoul and Mazen Mohmad[20],proposed"MEMA Technique" with static variables techniques. In the presented technique fewer steps are to be added to the weighted round robin (WRR). Moreover, a comparison of performance between the MEMA and WRR is presented. This algorithm is divided into two parts, the first one is determining the priority messages where the original balancer is divided into priority request balancer and normal request balancer. On the other hand, distribute the requests among the servers in which maximum weight obtains maximum number of request.

3. COMPARITIVE ANALYSIS

Title	Techniques & Mechanisms	Parameter Analysis	Future Work
Research on Task Scheduling Strategy Based on Cloud Computing Environment	Hybrid scheduling algorithm	Task allocation time, Makespan	Other QoS parameters will be included
A New Task Scheduling Algorithm using Firefly and Simulated Annealing Algorithms in Cloud Computing	Hybrid FA-SA algorithm	Make span	Energy performance and resource allocation
Dynamic Cloud Task Scheduling Based on a Two-Stage Strategy	Two-stage task scheduling framework	Makespan, Failure rate , utilization rate & waiting time	Minimize the energy consumption while guaranteeing the service quality
Task scheduling and resource allocation in cloud computing using a heuristic approach	Heuristic approach:(MAHP + BATS + BAR + LEPT)	Turnaround time,Response time,Utilization of CPU, memory and bandwidth	Further improving the turnaround time and Response time
A Parallel Task Scheduling Optimization Algorithm Based on Clonal Operator in Green Cloud Computing	Green clonal scheduling optimization algorithm	Execution time, Energy consumption, Resource utilization.	Optimize the energy consumption, design the dynamic adaptive task scheduling algorithm that is more efficient and reasonable.
Cloud Computing Online Scheduling	Proposed Ant Algorithm.	Make span, Load balancing, Reliability, Fault tolerance	Replication of Tasks factor is considered.

Cloud Service Scheduling Algorithm Research and Optimization	Genetic Algorithm-Chaos Ant Colony Optimization (GA-CACO)	Makespan and flow time	Improving convergence speed
Task scheduling for cloud computing using multi-objective hybrid bacteria foraging algorithm	MHBFA: (Genetic algorithm+ Bacterial foraging) algorithm	Make span, energy consumption	Reducing Cross Over & Mutation Time
Genetic-Based Task Scheduling Algorithm in Cloud Computing Environment	Tournament Selection Genetic Algorithm (TS-GA)	Completion time, Cost and Resource utilization	Dynamic characteristic of VM
Task scheduling algorithm in cloud computing based on modified round robin algorithm	Modified Round Robin algorithm (MRR)	Average waiting time	Other parameters such as VMs, datacenters, memory, bandwidth will be considered
An optimized max-min scheduling algorithm in cloud computing	Modified Max-Min (MMax-Min) algorithm	Makespan and Load Balancing	Energy conservation by lengthening the scope.
OCSA: Task Scheduling Algorithm in Cloud Computing Environment	Oppositional cuckoo search algorithm (OCSA)	Makespan and Cost	Quality of service (QoS) parameters can be integrated
Scheduling of Heterogeneous tasks in cloud computing using Multi Queue (MQ) Approach	Multi Queue (MQ) task scheduling algorithm	Makespan and Average resource utilization	Min-Min algorithm will be integrated
Time Effective Workflow Scheduling using Genetic Algorithm in Cloud Computing	PEFT(Predict earliest Finish Time) genetic algorithm	Execution time and cost	Modify the algorithm to suitable for workflows with large number of tasks.
Naïve Shared Based Approach of Load Balancing Named As Hybrid Algorithm in Cloud Computing	Hybrid Algorithm (Throttled + Equally spread Current Execution)	CPUutilization, Throughput, Response Time, Waiting Time , Turnaroud Time,Fairness, Resource Cost	Improve the algorithm for heterogeneous environment such as big data
Load balancing in cloud using aco and genetic algorithm	Load Balancing Enhanced Genetic (EGA) algorithm	Makespan	Energy conservation, VM Management
Cost Effective Expa-Max-Min Scientific Workflow Allocation and Load Balancing Strategy in Cloud Computing	Expanded Max-Mi (Expa-Max-Min) algorithm	Makespan and Cost	Energy conservation
OLOA: Based Task Scheduling in Heterogeneous Clouds	Oppositional Lio optimization algorithm.	Makespan, Cost and resource utilization	Quality of service (QoS) parameters can be integrated

Multi-Objective Task Scheduling in Cloud Computing Using an Imperialist Competitive Algorithm	Meta-heuristic method based on ICA (Imperialist Competitive Algorithm)	Execution time	Integrating MPQMA metaheuristic methods is used to improve tasks scheduling
An Advanced Algorithm for Load Balancing in Cloud Computing using MEMA Technique	MEMA Technique in WRR algorithm	Execution Time	Maximizes the reliability with less response time for urgent requests

4. CONCLUSION

Task Scheduling plays an important role in enhancing cloud computing performance. This paper reviewed algorithms, techniques used for scheduling a task and parameter analysis used in cloud computing of an existing task scheduling mechanisms. Major papers reviewed about the tasks scheduling algorithms based on makespan, cost, priority, energy consumption and resource utilization. Considering this survey my work will be related to schedule the task by implementing a hybrid algorithm.

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