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TCDC: TRANSFORMATION OF CLOUD DATACENTER FRAMEWORK TO ENHANCE BUSINESS VALUES USING EFFICIENT SCHEDULING ALGORITHM

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ABSTRACT

As per current trends, Cloud is regarded as the computational model for Hyper Scale Computing and science cloud applications, which deals with complex and highly complex and intensive data. Cloud computing is a utility computing technique which involves a scheduling environment on demand and promotes scalable delivery models to the cloud users. The process of scheduling involves both the job and resource scheduling methods in a Cloud environment. The goal of this paper is to develop architecture and an algorithm for scheduling to manage the resources of cloud efficiently. The bio-inspired Efficient Deadline Based Ant Colony Optimization (EDBACO) technique is used for the scheduling of cloud resources in the proposed approach. It aims to end up with the optimal solution for the matching of the exact resources with the jobs. The simulation results of the proposed algorithm involve the parameters like success ratio and the CPU utilization. Moreover the proposed approach performs well compared to the existing conventional algorithms.

Keywords: cloud computing, job scheduling, resource scheduling, colony optimization, swarm intelligence, cloudSim.

1. INTRODUCTION

Cloud computing is a growing idea in the world of IT, born out of the necessity for computing. It brings the user access to data, applications and storage that are not stored on their computer. For a very simple cloud computing overview, it can be understood as a delivery system that delivers computing the same way a power grid delivers electricity. To the average computer user it offers the advantage of delivering IT without the user having to have an in depth knowledge of the technology. Similar to the way a consumer can access electricity without being an electrician. A cloud computing overview will show how the cloud can not only simplify in house computing operations, but also change the way products are deployed to its users. A product developed with SOA architecture. Cloud Computing is an emerging technique. Recently it is found that Researchers are interested in using cloud for performing scientific applications and even the big organizations are on the verse of switching over to hybrid cloud. Many complex applications require parallel processing to execute the jobs effectively.

According to the NIST," Cloud computing is a model for enabling ubiquitous, convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models" [2]. Cloud computing involves three service models namely Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Saas deals with hosting application as a service to the customers. Paas is a kind of application delivery model which provides the resources for building the applications in cloud. It involves application design, testing, deployment and hosting. Cloud computing actually is not a one-size-fits-all affair. There are numerous ways to deploy the infrastructure. The IaaS will depend on the application and how the cloud service provider had chosen to build up the cloud solution. In this paper we deal with the infrastructure as a service model. The datacenter (DC) is a location where the servers are placed and maintained. The DC that provides support for the cloud servers are called as Cloud Data Centers (CDC). The cloud datacenters can deal with huge volume of data which are highly intensive. In current trends the business is demanding more and more services based on various terms of efficacy such as make span, performance and flexible datacenters within affordable budget. In near future the number of cloud users will hit the peak so it's high time to develop a solution to meet the business needs. In this paper we promote the ways to restructure and transform the existing datacenters according the business needs thereby increasing the efficiency of the cloud datacenter. The techniques for transformation involves framework designing and scheduling algorithm. In the proposed method it provides the success ratio, CPU utilization and the makespan. The proposed work methodology will improve the performance and the analysis of the workflow strategies than the existing work.

2. RELATED WORK

The communication and synchronization among parallel processes there is a decrease in utilization of CPU resources. It is necessary for a data center to achieve the utilization of nodes while maintaining the level of responsiveness of parallel jobs. The cloud computing is attracting an increased number of applications to run in the remote datacenters. Many complex applications require parallel processing capabilities. Some of the parallel applications show a decrease in utilization of CPU resources whenever there is an increase in parallelism if the jobs are not schedule correctly then it reduces the

computer performance. Several algorithms and protocols are proposed regarding the scheduling mechanism of the cloud computing. But very few algorithms are proposed to detect the scheduling mechanism in cloud computing. Most of the authors consider a regular monitoring region in their protocol, which is not a real life scenario. Practically the monitoring region is always irregular as the clouds are randomly deployed. Here by is the survey on various papers based on scheduling in cloud environment. Earliest Deadline first is the optimal scheduling algorithm for uniprocessor system in the real time system. The limited preemption scheduling technique is beneficial for preemptive and nonpreemptive scheduling [4]. Traditional scheduling algorithms typically aim to minimize the total time cost for processing all tasks. However, in cloud computing environments, computing capability different resources, and so does the cost of resource usage. Therefore, it is vital to take into consideration the usage cost of resources. Along this line, in this paper, we proposed a modified algorithm based on PSO to solve the task scheduling problem in cloud computing environments. Specifically, by adding a cost-aware fitness function to quantify the cost of resource usage, along with the fitness function for time cost, our method can achieve the goal of minimizing both the processing time and resource usage, and therefore reach a global optimal solution. Besides, our experiment on a simulated cloud computing environment proves the efficiency of our proposed algorithm. [5]

An optimized algorithm for task scheduling based on genetic simulated annealing algorithm is proposed. Here Qos and response time is achieved by executing the high priority jobs (deadline based jobs) first by estimating job completion time and the priority jobs are spawned from the remaining job with the help of Task Scheduler. Three scheduling algorithm First come first serve, Round robin scheduling and is generalized priority algorithm. In FCFS resource with the smallest waiting queue time and is selected for the incoming task. Round Robin (RR) algorithm focuses on the fairness. The tasks are initially prioritized according to their size such that one having highest size has highest rank in general prioritized algorithm. The experimental result shows that general prioritized algorithm is more efficient than FCFS and Round Robin algorithm. [6].

3. ARCHITECTURE

The major actors in the Cloud computing environment are Cloud Users, Cloud service Providers and the Cloud Resource Brokers. The CU generally send request for the cloud data center resources, these requests are submitted as jobs for the DC. The job assigned will vary from user to user. This task requested by the user, then reaches the Cloud Resource Broker. The CRB acts as intermediary between the user and the service provider. The Cloud Service Providers (CSP) then helps the user in identifying the exact resource for the uses request. Thus it is a full duplex process where the CU send request which then reaches the CRB, that helps to sort out the exact CSP and finally the CSP manages to ping the exact resource. After resource is being determined, it is then send to CRB and eventually delivered to the CU. The goal of the CUs is to get their job done with in the stipulated time period with greater accuracy and affordable cost. This method of getting the job done with minimum time and resource increases the business values to higher extent. In order to meet all these business needs we propose a cloud arbiter that helps the user to select the exact cloud resource and thereby enhancing the profit level with optimal resource utilization.

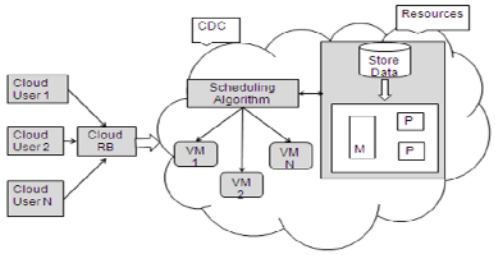

Figure-1. Overview of Cloud Architecture.

For individual enterprises, cloud services provide benefits that broadly fall into categories of lowering overall cost for the equivalent services, increased strategic flexibility to meet market opportunities without having to forecast and maintain on-site capacity with instant scalability, parallel processing capability which reduces the task processing time and response latency system redundancy which improves reliability.

4. DETAILED DESIGN FRAMEWORK

Framework is being designed for the Cloud Resources Broker (CRB) that involves the scheduling policies in the cloud environment. The users access the cloud via internet. A novel and an efficient framework for the CDC (Cloud Data Center) broker is being developed. This high level design is being developed keeping in mind the requirements of the cloud users as well as the cloud service providers. The key player in this model would be able to make use of the results to provide means for the cloud users and cloud service providers to publish service requirements and functionalities and provide a service to find the best match between them. They can earn revenue for this basic service or also provide value added service to the CSP to facilitate the deployment of the service. The Cloud Resources Broker can be considered as an architectural, business and IT operations model that enables the delivery and management of different cloud services in a framework that provides consistent provisioning, security, administration and other support. In this use case, an CSP planning to deploy a service in the cloud approaches a CRB with a given set of functional requirements and constraints (including costs, performance etc.) with the aim of selecting the best available match of IPs in terms of the functional requirements as well as other variable constraints like cost, SLA parameters and other non-functional requirements.

The CU submit service request to the cloud and it will be monitored by the SLA monitor which in turn will interprets the request submitted by the user for the Qos request before determining whether to accept or reject the request. It is also responsible to monitor the progress of the submitted job. If any violation is observed from the Sla it has to act immediately for the corrective action. It first checks whether the request can be satisfied by fulfilling the Qos parameters or not .If the CSP can fulfill the consumer then accept the request else it will reject it. It also monitors the job if there is any occurrence of violation then it has to take remedies. The violation may be failure of resources and memory. Cloud resource discovery may be provided basically as the task in which the provider should find the appropriate resources in order to comply with the incoming cloud user request. Considering that one of the key features of the cloud computing is the capability of acquiring and releasing resources on-demand, resource monitoring should be continuous. It is basically finding the resources for the respective tasks and jobs. Consumers can acquire and release resources on demand so it must know the availability of resources at a particular time. The aim of the resource discovery is to find out how many resources are available at a particular time interval for the jobs to be allocated.

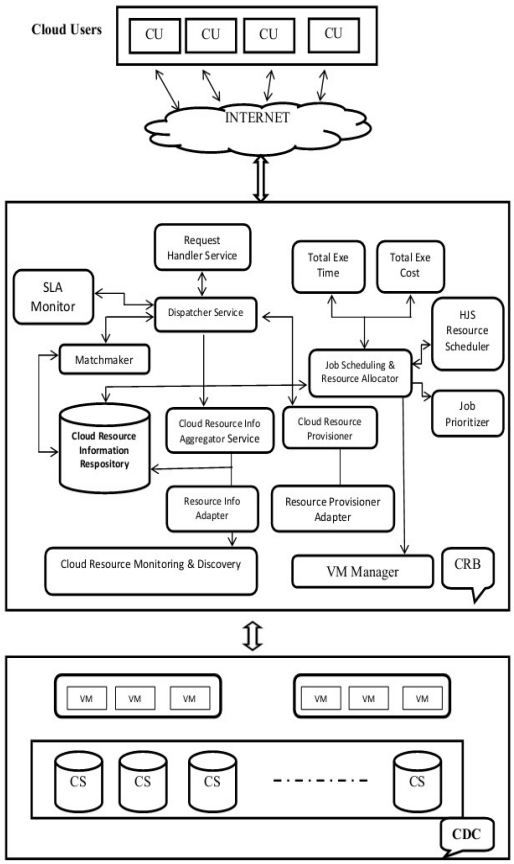

Figure-2. Cloud datacenter framework.

5. SCHEDULING IN CDC

Scheduling is the allocation of various jobs to the given resource in a given period of time. The scheduler performance the function of allocating different types of resources with respect to the constraints given by the jobs and the CSPs (Cloud Service Providers).For the need of effective performance in cloud datacenters, we need effective scheduling techniques. The scheduler is used to share the system resources or to achieve a target quality of service. The scheduler is concerned with throughput, latency, response time and fairness. The constraints can be the number of users, deadline stipulated for the given task, the given budget and the maximum resource utilization of resources from the CSPs. So before we design the scheduling algorithm for the cloud datacenter we need to design it by considering the constraints. The main aim of this project is to find the best mapping solution which meets the predefined system load constraint to the maximum level, or to make the migration cost for the load balancing as low as low possible. There are certain basic terminologies have to be understood to proceed with the scheduling process in cloud datacenter. Task is considered as the minimum computational unit to run on a node. It is an indivisible schedulable unit. The task may be independent or it can have dependencies too. Job is a computational activity made up of which is a combination of several task that requires different processing capabilities and also requires different types of resources such as CPU and memory constraints. So task is the minimum computational unit whereas the job is the set of task. Each job may have various parameters such as required data, desired completion time often called deadline, expected execution time and job priority. Resources are the things that are required to carry out an operation; it may include CPU, memory and bandwidth. Processor provides the resource for data processing, a data storage device or network link for the data transportation. The requirement of the user has to be satisfied with in the deadline stipulated by the user and it has to be with in the budget level as expected by the user. The prior task for developing scheduling algorithm is to consider the constraints such as with minimum cost and complete the task within the specified time, so that the given job gets completed in a given amount of time with some specific budget constraints. Optimization criteria are mainly used during scheduling decision and it represents the goals of scheduling process. Typically the user requirement is to maximize the resource usage, number of successfully completed jobs and to minimize the response time. The criteria are mainly expressed by the value of the objective function which allows us to measure the quality of the computed solution and also to compare it with the different solutions.

Whenever we want to map the jobs on the resources the optimization criteria and its constraints has to be considered. From the CSP's perspective it has to perform maximum resource utilization and with optimal time. To design an objective function for the scheduling algorithm based on the constraints and optimization criteria which is the best solution for the scheduling

problem. The problem of mapping jobs to resources is a kind of NP - Problem. These problems of mapping tasks on distributed services belong to a class of problems known as NP hard problems. Solutions based on the exhaustive search are very difficult since the overhead of generating scheduler is very high. In a cloud environment scheduling decisions must be made in the shortest time possible as there are many users competing for the resource and within time. These kinds of scheduling problems can be handled by some meta heuristic techniques. The major players in for scheduling in the cloud environment are the cloud consumers and cloud providers. The cloud consumers execute the jobs for solving problem of varying size and complexity. The user has to wisely select and aggregate the resources and the trade-off should be made between time and cost. The cloud providers contribute the available resources for the execution of the consumer's job. Its major task is to increase the resource utilization and maintain tradeoff between local requirements and market opportunities. Since the CSP spend more on the infrastructure and resource building they have to gain profit in return and need to increase their business values.

6. EDBACO ALGORITHM

Ant Colony Optimization is a kind of swarm intelligence technique based on bio-inspired algorithm. It is an arithmetic algorithm to find the optimal solution for the problem. The ACO algorithm models the complex behavior using the simple agents. Ant Colony Optimization uses an artificial stigmergy. It is a technique for solving the problems which can be expressed as finding good paths with the help of graphs. Every ant tries to reach its route between the nest and food source. It leaves the pheromones trail behind it such that the other ants follow them with the trail left behind. The ants become increasingly likely to follow the shortest path since it is constantly reinforced with the larger amount of pheromones. The pheromones in longer paths get evaporated first.

Table-1. ACO terminology.

ACO	Graph
Ants	Agents /Artificial ants
Visibility	Reciprocal of Distance ŋ
Pheromones	Artificial Pheromones T
Food/Nest	Nodes in graph
Foraging behavior	Random Walk through graph.

The EDBACO is the efficient deadline based Ant Colony Optimization method. Where the tasks are segregated based on the deadline priority then for job scheduling we use the ACO technique to perform the scheduling of resources in the cloud datacenter. Thus both the job and resource scheduling is done with the single algorithmic technique.

$$P_{C_{ij}} \mid s^p = \frac{\tau_{ij}^{\alpha} * \eta_{ij}^{\beta}}{C_{ij} \in \sum_N (S^p) \tau_{ij}^{\alpha} * \eta_{ij}^{\beta}} \forall C_{ij} \in N(S^p)$$

In the above equation s^p denotes the partial solution, N is the set of all paths, c_{ij} is the path from the start, P denotes the probability, t_{ij} is the amount of pheromone left in the pathway, h_{ij} is the heuristic factor. Finally αand β are the algorithmic parameters.

A. Pseudocode

Initialize the base attractiveness, τ, and visibility, η, for each edge; Segregate based on deadline priority; for i < Iteration Max do: for each ant do:
choose probabilistically (based on previous equation) the next state to move into;
add that move to the tabu list for each ant; repeat until each ant completed a solution; end; for each ant that completed a solution do: update attractiveness τ for each edge that the ant traversed; end;
if (local best solution better than global solution) save local best solution as global solution; end; end;

B. Flowchart for EDBACO

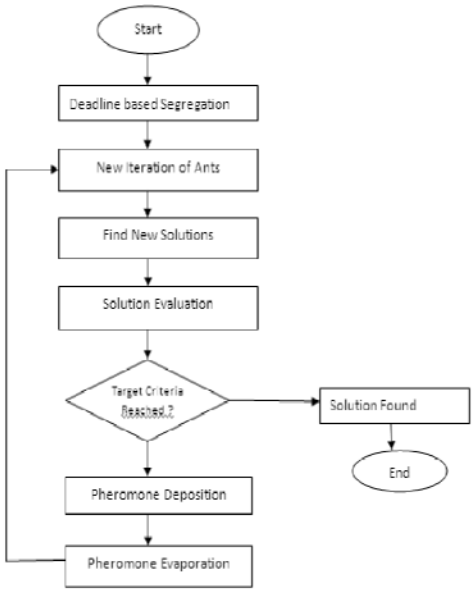

Figure-3. Flow diagram.

7. RESULTS AND DISCUSSIONS

The simulation execution for scheduling of cloud datacenter is being done in cloudsim toolkit. The major advantage of the EDACO algorithm is that it inherits parallelism; its positive feedback promotes the discovery of good solutions. It is well suited for dynamic applications.

Table-2. Average response time.

S. NO	Time to Response					EDBACO
	P1	P2	P3	P4	P5	
1	5	15	12	25	5	14.8
2	10	10	15	12	4	17
3	4	2	8	10	23	9.6
4	8	11	35	4	30	18.4
5	2	25	28	5	32	20.2
	Total average response time					16

The above Table-2 denotes the sample list of values for the scheduling in EDBACO. These values are then plotted in the graph to analyses the performance of the developed Efficient deadline based Ant Colony Optimization algorithm.

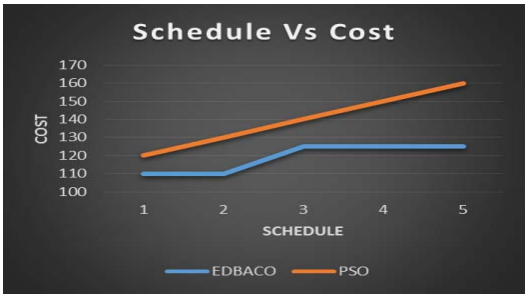

Figure-4. Schedule vs cost.

Figure-5. Schedule vs response time.

From the Figure-4 and Figure-5 the performance of the EDBACO algorithm can be analyzed which is above the optimal solution and hence it is proved to an efficient algorithm than the genetic algorithm.

REFERENCES

[1] Apurva Shah, Kotecha: ACO Based Dynamic Scheduling Algorithm for Real-Time Computing, 3(3), 20-30, July September 2011 Multiprocessor Systems", International Journal of Grid and High Performance.

[2] Jashweeni Nandanwar:"An Adaptive Real Time Task Scheduler", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 6, No 1, November 2012.

[3] Marko Bertogna and Sanjoy Baruah "Limited Preemption EDF Scheduling of Sporadic Task Systems" IEEE Transactions on Industrial Informatics, Vol. 6, no. 4, November 2010.

[4] Gang Zhao:"Cost Aware Scheduling algorithm based on PSO in cloud computing environment" International Journal of Grid and Distributed ComputingVol.7, No.1 (2014).

[5] Dr. Amit Agarwal, Saloni Jain:"Efficient Optimal Algorithm of Task Scheduling in Cloud Computing Environment" International Journal of Computer Trends and Technology (IJCTT) - volume 9 number 7- Mar 2014.

[6] Thamarai Selvi Somasundaram, Kannan Govindarajan" A framework for scheduling and managing HighPerformance Computing (HPC) applications in science cloud", Future Generation Computer Systems 34 (2014) 47-65.

[7] Dhinesh Babu L.D. a*, P. Venkata Krishna b et al., "Honey bee behavior inspired load balancing of tasks in cloud computing environments", Science Direct, Applied Soft Computing 13 (2013) 2292-2303.

[8] Swachil Patel, Upendra Bhoi:"Priority Based Job Scheduling Techniques In Cloud Computing", International Journal of Scientific and Technology Research, Volume 2, Issue 11, November 2013, ISSN 2277-8616.

[9] Jia Yu, Rajkumar Buyya, Scheduling scientific workflow applications with deadline and budget constraints using genetic algorithms, Sci. Program. J. (ISSN: 1058-9244) 14 (3–4) (2006) 217-230. IOS Press, Amsterdam, the Netherlands.

[10] Biao Song, Mohammad Mehedi Hassan, Eui-nam Huh, A novel heuristic based task selection and allocation framework in dynamic collaborative cloud service platform, in: CloudCom 2010, pp. 360– 367.

[11] Backialakshmi, Sathya Sofia:"Survey On Scheduling In Cloud ", IJERGS, Nov 2014.

[12] Fengguang Tian, Keke Chen, Towards optimal resource provisioning for running mapreduce programs in public clouds, in: Proceedings of the 2011 IEEE 4th International Conference on Cloud Computing, 2011, pp. 155-162, July 04-09.

[13] Mrs.M.Padmavathi 1, Shaik. Mahabbob Basha, Professor 2, Mr. Srinivas Pothapragada, CEO of Ostilio (2014)" A Survey on Scheduling Algorithms

in Cloud Computing", IOSR Journal of Computer Engineering (IOSR-JCE), eISSN: 2278-0661,p-ISSN: 2278-8727, Volume 16, Issue 4, Ver. III, PP 27-32.

[14] Hai Zhong, Kun Tao, Xuejie Zhang, An approach to optimized resource scheduling algorithm for open-source cloud systems, in: The Fifth Annual China Grid Conference, 2010.

[15] Lu Lu, Xuanhua Shi , Hai Jin, Qiuyue Wang, Daxing Yuan, Song Wu:"Morpho: A decoupled MapReduce framework for elastic cloud computing", Science Direct, Future Generation Computer Systems. 36(2014) 80-90.

[16] http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf.