# A STUDY OF CONSOLIDATION ENHANCEMENT VIA TASK SCHEDULING ALGORITHMS IN MULTI-CLOUD ENVIRONMENT

**ANITA MISHRA**

*Research Scholar, Dept. of Computer Application,*

*Sri Satya Sai University of Technology & Medical Sciences,*

*Sehore, Bhopal-Indore Road, MadhyaPradesh, India*

*Dr. Jitendra Sheetlani*

*Research Guide, Dept. of Computer Application,*

*Sri Satya Sai University of Technology & Medical Sciences,*

*Sehore, Bhopal Indore Road, Madhya Pradesh, India.*

## ABSTRACT

The cloud computing gives the possibility to have computing resources over the internet without owning the infrastructure. The relation between the cloud service consumers (CSC) and the cloud service providers (CSP) is formalized through the SLA (service level agreement). So the service provider must achieve best performance, shortest response time and optimal utilization of resources to respect this SLA. In cloud computing many tasks requires to be executed by the available resources, so the task scheduling become a big challenge in the cloud computing. To outperform this challenge there is a need to implement a good scheduling strategy with good scheduling algorithms looks at the requirements and priorities established. In this paper, a comparison of task scheduling algorithms in cloud computing is presented, in order to classify and identify those who may be most appropriate in the case of independent priorities tasks. We will show that the scheduling of tasks needs as well a good strategy which connects the customers' needs to scheduling of their tasks.

**Keywords—** Cloud computing, Task scheduling algorithm, scheduling strategy, task priority, SLA.

## INTRODUCTION

In the literature there are a lot of definitions of Cloud Computing and this is one of them. The International Organization for Standardization defined the cloud as a paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand. The cloud computing paradigm is composed of key characteristics, cloud computing roles and

activities, cloud capabilities types, cloud service categories and cloud deployment models [1]. The main cloud characteristics are Broad network access, Measured service, Multi-tenancy, On-demand self-service, Resource pooling, rapid elasticity and scalability. The roles and activities of cloud are: Cloud service customer, Cloud service partner, Cloud service provider. The cloud service categories are: Communications as a Service (CaaS), Compute as a Service (CompaaS), Data Storage as a Service (DSaaS), Infrastructure as a Service (IaaS), Network as a Service (NaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). The Cloud deployment models are: Public cloud, Private cloud, Community cloud, and Hybrid cloud. The Cloud computing cross cutting aspects are Auditability, Availability, Governance, Interoperability, Maintenance and versioning, Performance, Portability, Protection of PII, Regulatory, Resiliency, Reversibility, Security, Service levels and service level agreement [1]. Cloud computing gives the possibility to use computing resources over the internet without owning the infrastructure. It provides the possibility to access applications and data from anywhere based on SLA (Service Level agreement). The management of resources is done by a set of existing and new technologies like virtualization and Service-Oriented Architectures (SOA) [2]. In the cloud computing the quality of service (QOS) is a measurement of user's satisfaction to the services provided. And, these services are defined in SLA, which is the contract between the cloud service consumers (CSC) and the cloud service providers (CSP) [3]. As the numbers of cloud users is increasing rapidly, the researchers have to find an optimal solution for tasks scheduling mainly when we should respect the SLA terms. The task scheduling in the cloud computing is the mechanism that maps user's tasks to the appropriate resources (VMs).

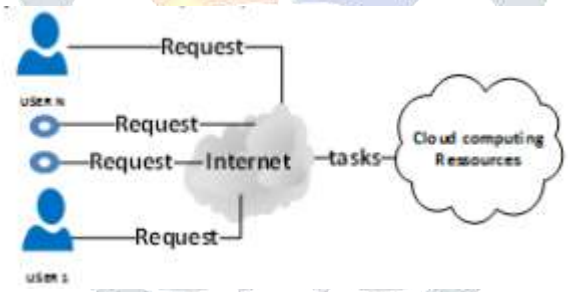



**Figure 1 : The Cloud Computing Tasks**

As depicted in the figure 1, in the cloud there are many users submitting their tasks which have different SLA constraints, to be executed by the available shared pool of resources simultaneously. For example, some consumers require more memory to store data, and some others may need more CPU time to compute complex task and so on. Thus, an effective strategy and effective task scheduling algorithms are needed. The main objective of this paper is to study and compare a variety of task scheduling algorithms that are used in the cloud computing. And, also give a classification of these algorithms according to the consumers and providers need. We will also show that studying the scheduling solutions with isolated manner is insufficient to meet the needs of customers and therefore compliance with the SLA. The remaining parts of this paper are organized as follows: section II defined the task and scheduling, section III present State of Art, Section IV present

comparison between the tasks scheduling algorithms and finally Section V concludes the paper and presents the future work.

## TASK SCHEDULING

In the literature a task is a single process or multiple processes which will be executed on a compute node presented by VM [4]. The task scheduling in the cloud computing is a set of rules and parameters, which determine and choose the task to be executed on the resources between a variety of possible tasks at a particular time [3]. The Task scheduling algorithms are the responsible for distribute the tasks submitted by the users onto available resources [5]. In the cloud there are different types of tasks for example dependent or independent tasks, periodic or permanent tasks, preemptive or non-preemptive tasks and so on. The decision of a type of scheduling is related, implicitly or explicitly, to the nature of priority of the task. The tasks priority can be defined with different parameters in different level on different time. For example, it can be based on simple criteria or the combination of them. Following are some ones who are used in some papers. -The Task execution cost: the costs that need the task to be executed in the specific virtual machine.

-The task age: the time that waited the task to be executed and this age begin when the task is entered to the cloud and finished in the execution of the task in the VM.

-The task size: the length or the number of MIPS that needs this task to be executed in a specific VM.

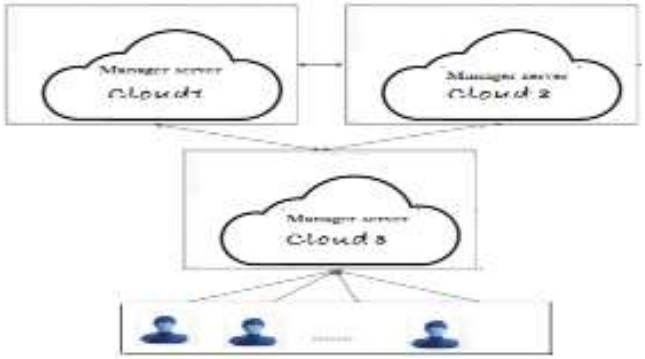
-The task deadline: the time that the task considered failed.

After the definition of the priority of the tasks, we have to assign them to the appropriate resources. Thus, this chooses can be based on the load of VM (maximum load or minimum load), the execution time (minimum execution time, maximum execution time), the capability of VM(number of MIPS) and so on. In the literature, there are different types scheduling techniques with different characteristic like Static or Dynamic one, centralized / Distributed one, preemptive or non-preemptive one, cooperative scheduling, immediate or online one, batch or offline mode.

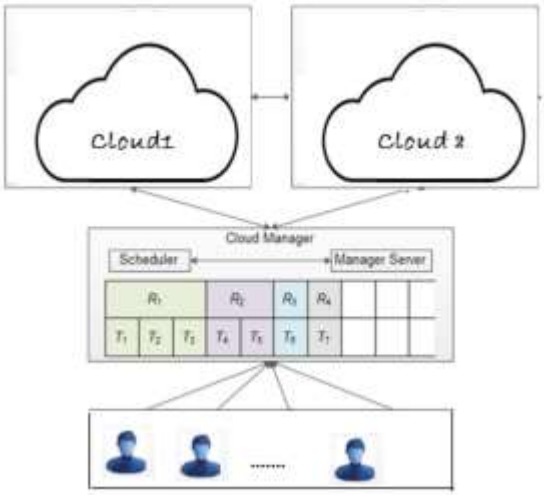
## MULTI-CLOUD MODELS

A multi-cloud model constitutes of two or more cloud systems connected with each other via Internet. Researchers in the past have assumed few multi-cloud models as per their scheduling requirements. In [3],[12] the cloud model is assumed that at every data center there will be a manager server as in Fig 1 which will have all information about its own Virtual machines including their current status. The other responsibility of a manager server is to keep track of resource characteristics available at other cloud by communicating with the manager servers of other clouds. So when a application request arrives at a cloud, its manager server divides the

application into tasks, and decides which cloud will execute which task depending upon the resource availability of the other cloud. It distributes the tasks among those cloud with ready and available resources.




In [3] the cloud model almost remains the same as above except there will be centralized manager server known as the cloud manager that have the status information of all VMs of respective clouds. A user request for executing a application is received by the central cloud manager, it divides the application into several tasks, and puts them in a queue. Each task is then allocated to an available VM of a cloud. This centralized model shown in Fig 2 is somehow better then the above model, because it avoids the frequent communication between the cloud managers of different clouds




**BENEFITS OF MULTI –CLOUD**

This type of cloud implementation is very much handy to many businesses who want to benefit from cloud computing without being burdened by the risks associated with it. It can be a best option for large a company that constitutes several divisions/departments that perform different functions and hence require different cloud services [20]. The following are some benefits of multi-cloud

1- Lowering Vendor Lock-in :The vendor lock –in [18] problem refers to a situation during which customers becomes dependant on a single cloud provider , and is not able to transits to other service providers which may

be due to incompatible technology or legal constraints. This situation is fully avoidable in heterogeneous environment like cloud

2- Flexibility: By deploying more than one cloud services an organization is not constrained to a single service provider for delivering user services[18]. Rather by choosing multiple cloud providers,a organization can smoothly distribute workloads, and application with different technical needs to multiple cloud providers.

3- Lower risk of DDOS attacks : [19] A higher degree of protection can be provided from the DDOS attacks. When multiple data centers are used ,then a possible DDOS attack will not necessarily lead to failure of the entire system , as because ,

4- As resources reside on multi cloud, it therefore creates a resilient architecture. 5 Limitations of Multi-cloud

1- As a cloud system grows wider and wider, more complex it becomes to manage such a large system.

2- Another issue to focus is security. As a no cloud services are used, so strong security algorithms needs to be implemented across multiple cloud platforms. 6 Application model and Problem Statement In a scenario , where multiple number of clouds are collaborating , the following parameters are initially figured out:

- Variable C, is used to represent the set of clouds participating in the entire multi-cloud architecture, where C = { C1, C2, C3, …., Cm }

- Variable A, is used to represent the set of applications that are submitted to the multi-cloud, where A = { A1, A2, A3, …., An } - Variable Ti is used to represent a set of tasks belonging to application Ai , where Ti = { Ti1, Ti2, Ti3, …., Tik }

Other then the above variables 2 data structures are used namely DAG(Directed acyclic Graph) and ETC(Expected time to compute) matrix. - Every application has its corresponding DAG ,ieGi = (Ti, Ei ) (Ti is declared above, and Ei represents a set of edges in Gi . An edge Eijk∈Ei , where Eijk = (Tij → Tik) For example let T13 and T12 are tasks belonging to application Ai , and let task T13 is dependent on T12 . Then there will be an edge E123 in G1 , where E123 = (T12 → T13) , i=1, j=2 , k=3.

- For every task belonging to the different applications submitted to the multi-cloud, their corresponding execution time on each cloud is represented using a 2x2 matrix known as ETC. Where each element in the matrix ETCij,c refers to the execution time of jth task ith of application i on cloud c. The problem statement, is to select a cloud from a given set of clouds to which the task of an user application is to be forwarded.

7 About The task scheduling algorithms in Multi cloud A single cloud provider with the help of internet and a remote server stores data, applications. It handle user request for various services like software, storage space, network bandwidth etc. The application which is received at a data center is a collection of tasks, which may be dependent or independent on each other. These tasks are further assigned to different virtual machines in a

scheduled manner. For this a scheduling policy is used and an optimal scheduling policy provides reduced makespan, increased cloud resource utilization, and reduced energy consumption. Therefore scheduling has been the most prominent topic in the field of distributed computing. Various studies and research have been conducted to obtain a optimal or near to optimal solution in a single unified cloud environment, but the same algorithms may not work for a multi cloud architecture.

## STATE OF ART

In the cloud many scheduling algorithms have been proposed. In this part of paper we present some of them. Before talking about the task scheduling algorithms used in the cloud computing, we can't neglect the basic algorithms, so we began with the basic algorithms and then the others.

**First Come First Serve (FCFS): i**n this algorithm the task that arrived first in the queue will be executed first.

**Last in First out (LIFO):** in this algorithm the last task arrived in the queue will be executed first.

**Shortest Job First (SJF)**: in this algorithm the task with shortest processing time will be executed first.

Priority Based: in this algorithm, a priority number (integer) is associated with each task; the one who has the highest priority is selected to be executed first. But this priority is changed depend the purpose that it used.

**The Round Robin Algorithm (RR):** in this algorithm the time is divided into multiple times quantum. Each task assign a time quantum, during this each task perform its operation.

**The Minimum Execution Time (MET):** in this algorithm the task is selected in random order, and assigned to the machine with the minimum expected execution time for that task, regardless of that machine availability.

**The Minimum Completion Time (MCT):** in this algorithm the task is selected in random order, and assigned to the machine that has the minimum expected completion time for that task.

**The Min-Min Task Scheduling Algorithm:** in this algorithm the task with minimum execution time is assigned to the machine with minimum execution time for that task.

**The Max-Min Task Scheduling Algorithm:** in this algorithm the task with maximum execution time is assigned to the resource that produces the minimum execution time for that task. Other algorithms have been proposed which are either the combinations of basic algorithms or the new algorithms.

**Genetic Algorithm Based Bi-Objective Task Scheduling in Hybrid Cloud Platform [6]:** This algorithm is based on the genetic algorithm, it focuses on hybrid cloud, it sends jobs to private cloud to minimizing the cost and sends jobs to public cloud to minimizing the execution time. The intention of this algorithm is to improve both cost and execution time in the same time in Hybrid cloud.

**Coherent Genetic Algorithm for Task Scheduling [7]:** This algorithm based on the genetic algorithm which considers resources, tasks cost and makespan as fitness criteria, the intention of this algorithm is to minimize the execution time and execution cost taking into consideration computational cost and computing capacity of the processing elements.

## CONCLUSION

In this paper, we made a comparison of the different approaches for scheduling tasks. We have shown that these Approaches do not give an overview of scheduling from the client to the VM. These approaches do not show how the SLA is respected, for each customer, knowing that the constraints are not the same for all. Based on a single approach can't respond of the varied needs of customers. This is why our future work is to propose a comprehensive approach that can respect the constraints of clients and better manage resources in cloud computing.There are several other parameters like the overall throughput, energy consumption, reliability etc, which were not focused on these algorithms. Of the algorithms proposed for multi-cloud environment don't include the deadline criteria of a task.The evolution of cloud to handle hundred and thousands of user demands, at a time, thereby facilitating resource sharing, reduction in loss of information, elimination of data storage on server side and many many more the topic of task scheduling will be prominent in all forms of cloud computing and in distributed architecture. Here, we discuss the multiple cloud architecture and the scheduling techniques applied to evenly distribute the workload across multiple clouds. Algorithms like Cloud list Scheduling (CLS), Cloud min min scheduling (CMMS), Minimum completion cloud (MCC), Median max algorithm (MEMAX), Multiobjective scheduling (MOS) are some methods suggested in the past for finding a near to optimal solution for task allocation.

## REFERENCES

[1] International Organization for Standardization ―Information technology — Cloud computing — Overview and vocabulary‖ ISO/IEC 17788 First edition 2014-10-15, Reference number ISO/IEC 17788:2014(E) © ISO/IEC 2014.

[2] P.D. Saronrex, R.K. Maheswari "Dynamic Consolidation of Virtual Machines In Cloud Data Centers For Managing Overloaded Hosts Under Quality of Service Constraints" International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com Volume 10, Issue 3 (March 2014), PP.40-47.

[3] V R BithiahBlessie,A.Stanislas,DrL.Arockiam "A State of Art Scheduling Algorithms in Cloud Environment" Dept. of Computer Science, St.Joseph College Trichy, Tamilnadu, India, International Journal of Advanced Research in Computer Science & Technology (IJARCST 2014) Vol. 2, Issue 2, Ver. 3 (April - June 2014).

[4] Definition of jobs and tasks, https://msdn.microsoft.com/en-us/library/bb525214 (v=vs.85).aspx

[5] Santhosh B , Dr. Manjaiah D.H ―An Improved Task Scheduling Algorithm based on Max-min for Cloud Computing‖, International Journal of Innovative Research in Computer and Communication Engineering , Vol.2, Special Issue 2, May 2014, Department of CSE & ISE, Vemana Institute of Technology, Bengaluru, India.

[6] Leena V. A., AjeenaBeegom A. S., and Rajasree M. S., Member, IACSIT ‖ Genetic Algorithm Based BiObjective Task Scheduling in Hybrid Cloud Platform‖ International Journal of Computer Theory and Engineering, Vol. 8, No. 1, February 2016.

[7] M. Krishna Sudha and, Dr. S. Sukumaran ―Coherent Genetic Algorithm for Task Scheduling in Cloud Computing Environment‖ Australian Journal of Basic and Applied Sciences, 9(2) February 2015, Pages: 1-8 ISSN:1991-8178.

[8] A.S. AjeenaBeegom and M.S. Rajasree ‖ Genetic Algorithm Framework for Bi-objective Task Scheduling in Cloud Computing Systems‖ R. Natarajan et al. (Eds.): ICDCIT 2015, LNCS 8956, pp. 356–359, 2015.Springer International Publishing Switzerland 2015.

[9] Santhosh B, Dr. Manjaiah D.H ―An Improved Task Scheduling Algorithm based on Max-min for Cloud Computing‖ International Conference On Advances in Computer & Communication Engineering (ACCE - 2014) on 21st & 22nd April 2014, Organized by Department of CSE & ISE, Vemana Institute of Technology, Bengaluru, India

[10] UpendraBhoi, Purvi N. Ramanuj ―Enhanced Max-min Task Scheduling Algorithm in Cloud Computing ‖international journal of application or innovation in engineering and management (IJAIEM) Volume 2, Issue 4, April 2013ISSN 2319 – 4847.