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Optimal Energy Efficient Frame work for Virtual Machine Scheduling

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Abstract

Cloud computing enables the use of virtual machine resources and reduces operating cost. Whereas the selection of virtual machine still remains a challenge due to no proper resource utilization and lack of optimal resource allocation. The services and storage space required for a particular resource is specified by the user. Hence the significant challenge exists in cloud computing is the variant level of performance in concern to utilization, throughput, stability, etc. The framework utilizes the novel Enhanced Moth Flame Optimization with Game Theory (EMFO-GT) algorithm.The module formulates an optimal VM scheduling and management process to promote the QoS during service execution. Thus improving the cloud efficiency by dynamically adjusting VM scheduling showing exceptionally high utilization.

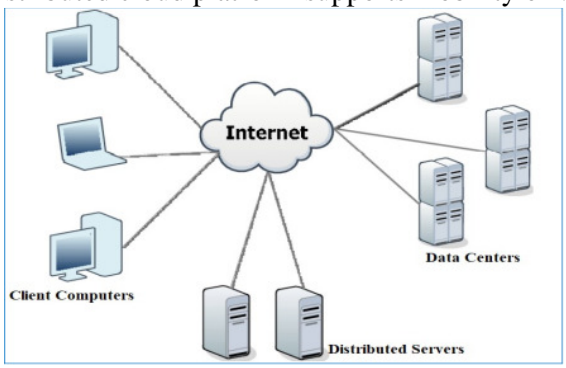
Keywords

Resource allocation, Task scheduling, Minimum operation time, Quality of Service (QoS), Virtual Machine, ECG data clustering.

1. Introduction

Cloud computing delivers huge computational resources, and a cloud service provider must allocate heterogeneous virtual machines for user applications. Thus optimal scheduling performed benefits both the cloud service provider and user. Simultaneously, these algorithms have to be designed to ensure that it satisfies the QoS constraints. Optimal allocation algorithm solves the requirement of users [1].Server less computing is the latest development in cloud computing for example, the Lambda function offered by Amazon Web Services. These functions can run either in the public or private Cloud. The concern here is that although users go on the pay-per-use model, the actual billing does not depend on usage and allocation. Therefore most of the time customer pays more than the necessity. Hence resource allocation and scheduling is a challenge that prevails in the existing Cloud. In server less, until a function is called, no resource is allocated or changeable [2]. However, this depends on the behaviour and execution of theworkload.The services are to be tunable, testable, resilient, and monitor. Figure 1 shows the major components of Cloud computingTask scheduling is a key concern for distributed environments that must manage several tasks in many resources, while improving resource utilization and the make span. Generally, task scheduling strategy maps submitting tasks to available resources in cloud environment according to their characteristics to achieve high performance computing [3]. The past few decades have witnessed the rapid development of optical communications [4]. In traditional terrestrial networks, WDM and advanced modulation formats were utilized to stretch the capacity limit of single-core SMF. However, conventional SMF solutions based on WDM may fall short in satisfying the capacity, spatial efficiency, power consumption, andcost requirements of high-performance data centre networks [4].In order to reduce the delay between the cloud server and the end users, edge computing has been introduced. In this paradigm, the computing resources are made available at the edge of the network near to or co-located with the end devices [6]. This provides a one-hop-away low-latency link between the edge cloud and the vehicles, thereby reducing the data shared with distant central cloud entities like

data canters and allowing real time access to radio link information at the edge cloud. Furthermore, this decentralized geographically distributed cloud platform supports mobility of vehicles.



Figue 1.1 : Components of Cloud Computing

Therefore, utilizing both edge and central cloud computing for side link RRM virtualization, a hybrid cloud framework can offer flexibility in placing radio resource control functionalities in central and edge cloud entities. This framework combines the benefits from centralized resource control and one-hop distributed scheduling [5] low signalling overhead.

Over the Internet, the way of storing and access to data and programs is termed cloud computing. This does not require a dedicated server in residence. Cloud computing provisions data access anywhere, any time. Google Drive, Apple I Cloud, Amazon is some of the big retailers in Cloud. Cloud computing is a platform that offers on-demand software over the Internet. Users go on with pay and use service in Cloud.

The Cloud services include Software as a Service, Platform as a Service and Infrastructure as a Service. For example, daily used Cloud are Face book, YouTube, Gmail, etc., and these offer flexibility, agility, scalability, and Simplicity.There is a significant disagreement, though, when it comes to deploying appropriate resource allocation schemes. Resource allocation has provided various advantages [6], particularly for Infrastructure as a Services, because it uses VM which meets the consumer demands.Many researchers have developed various meta-heuristic algorithms to optimize capital distribution [7]. The SLA is significant in handling cloud computing and providing applications. Agreements between cloud vendors and cloud users should be managed to reach consensus of SLA specifying the QoS characteristics [8]. Cloud computing is rapidly increasing in business, academia, and society with the pervasive progression in the domain Networking and Big data. Cloud computing groups are service computing, robotic computing, remote computing, and grid computing. This supports high storage [9], scalability, and productivity of on- demand computing facilities. Some computing models seek to take advantage of utility computing, and the most common paradigm in search of the highest benefit of reliability is the cloud computing system. Nevertheless, there is a potential challenge in data centers of cloud as it grows on resource usage. The cloud computing model's entire efficiency could be improved with the assistance of efficient dynamic resource allocation management. The virtual resource allocation method includes construction/destruction of virtual machines dynamically, without affecting the execution of the application. Therefore, assigning resources at the virtual machine level provides several distinct advantages [10], such as consistency in the distribution and migration of virtual resources.

Most of the existing infrastructure has dedicated computations and storage. Also, to keep a large data center operational, much energy is consumed. However, different resources, hypervisor, billing models differ across various providers. There requires a significant programming effort to deal with load balancing, resource management, effective utilization, etc. [11]. as there exists no unifying environment for these. Also, bandwidth, latency, network topology are the other challenges that have to be considered. Thus cloud computing models for large-scale applications require a new computing framework that can set future clouds [12]. In the past decade, task scheduling issues in distributed systems has drawn researchers' interest [13]. The latest literature focuses mostly on distributed processing, which has issues on task scheduling. It is essential for cloud computing setting to handle

multiple variables like resource usage, user task execution cost, completion time, power consumption, and fault tolerance in task scheduling process[14] The important implications of cloud technology handling resource management, is known as task scheduling, have been parsimoniously clarified to establish and facilitate a scheduling management system to deploy cloud computing engineering.

2. Literature Review

The massive data from real-world applications are stored and generated as technology advancements [15]. Meta heuristic algorithms can find the optimal solution within a reasonable time and exploit good in many areas, especially to solve continuous optimization. The Binary Sine Cosine algorithm has a floating-point position vector with an S-shaped transfer function to search binary space in the bounded interval of [0, 1]. With feature selection problems, the algorithm applied to the optimum feature subset. They are thus showing competing results for most of the datasets. Further, the author's point on its usage in solving multiple objectives is a significant consideration[15].

The proposed an algorithm by considering four objectives, and all the objectives are minimized independently and Simultaneously. Thus has shown significant performance improvement over many other algorithms. The primary consideration was that the algorithm seriously considered all the distribution system constraints, including conductor limits, voltage limits of all loads, etc [16]. The algorithm also produced quality solutions with better stability and inspired this research in choosing this algorithm.Proposed a secure and performance-aware scheduling model to minimize the security threats assigning virtual machine tasks, verifying their execution order and their attack response policy in a heterogeneous infrastructure. Though the proposed model had a reasonable completion time, the algorithm had limitations due to its absence in dynamic scheduling [17]. Proposed optimal energy-efficient scheduling for the virtual machine and deducing the lower-bound VM migration problem. Though the scheduling algorithms show efficiency, the authors have marked the open issues related to cloud scheduling. These include: i) finding a near-optimal solution is NP-complete, ii) Load balancing and energy efficiency need to be combined for producing an integrated solution, iii) users' multiple requests have to be considered [18].Focused on cyberphysical systems, which gained popularity in critical areas such as healthcare, traffic control, etc. Many enterprises utilize cyberphysical systems to handle and implement distributed computing resources. The authors find an optimal virtual machine scheduling for cloud-based cyberphysical systems enhancing the QoS [19]. Though the algorithm minimized the downtime and maximized the resource utilization, the authors point on multiple user requirements in concern to QoS has to be taken into consideration [19].

Proposed a virtual machine scheduling model to reduce power consumption and performance interference among virtual machines. Virtualization saves the energy of cloud datacenters. Apart from this, virtual machines are deployed on physical hosts that perform computation as an independent unit. Considering a single virtual machine, the physical resources compete, causing degradation due to interference among the virtual machines. However, the method produced only less improvement on the CPU utilization preventing individual servers from highlighting [20].Addressed energy consumption, utilizing the Dynamic Voltage Frequency Scaling approach. Concentrating onthe cloud data center energy efficiency, the scheduling minimized the process waiting time and starvation[21]. However, the load balancing scheme and factors that were not included in the study are significant drawbacks[21].An increase in application increase cloud system complexity. [22] Proposed a novel VM scheduling using the loan and redeem system. The technique presents two types of boosting during execution.These are i) under credit for non-boosted execution and ii) boost credit for boosted execution.The credit rating is reflected by the characteristics of the application running on a virtual process.The credit decides to boost and reflects on the application characteristics. The mechanism was run on a Xen hypervisor 4.6 and compared with a credit scheduler. The system was evaluated for response time, network bandwidth, utilization. The scheduler improved the I/O performance for a cloud system. However, the deduction time of boost credits was controlled, and the scheme achieved 39% less response time. Therefore a dynamic solution for cloud virtual machines remains a challenge [22].In order to improve energy [23] proposed a model for efficient resource allocation. The

optimization involves unit power efficiency regulation. It determines the load of the server and a strategy to balance the stability. The server chooses an appropriate task quantity guaranteeing optimization. However, it does not regulate the dynamic distribution of the task. [24], analyzed the difference between clusters considering a short average execution time algorithm. The algorithm takes a virtual machine in a heterogeneous environment. However, the algorithm was effective only when the number of tasks and clusters were high.

3. Importance of Task Scheduling and Its Challenges

The problem of task scheduling in a distributed setting has attracted the attention of researchers in recent years. Recent studies mainly focus on distributed computing that has task scheduling problems. Based on varies factors such as resource utilization, the total cost for all the user task execution, completion time, power consumption and fault tolerance in the task scheduling mechanism. It's found to be highly critical in the cloud computing environment. Here, a right concession should be made among the energy consumption. Hence, a right concession should be made among the energy consumption and the resolution time with the precedence environment. Hence, a right concession should be made among the energy consumption and the resolution time with the precedence-constrained parallel application. Which is possible with the bi-objective optimization problem and problem's solution. An improvement in one objective can be made by worsening the other objective. This provides with the biobjective solution to a problem instead of providing a unique solution to a problem with the set of Pareto points. Task scheduling is known to be an NP-complete problem. Cloud computing infrastructure not only promotes virtualized condition for the application but also makes those applications to be utilized effectively and minimally thereby providing high user benefits.

3.1 Taxonomy of Task Scheduling Algorithm

In this section, the important aspects of resource management in cloud computing infrastructure known as a task scheduling has been explained parsimoniously that makes a way in creating and promoting scheduling management framework for engineering implementation for cloud computing. The main role of cloud computing is to promote the users with optimal scheduling of task with the minimum operation time, achieve load balancing with the higher quality of service (QoS). The important objective of the task scheduling algorithm is to retentively achieve this important objective namely, task scheduling helps to minimize the make span and energy for physical machine (PM) as shown in below Figure 3.1.

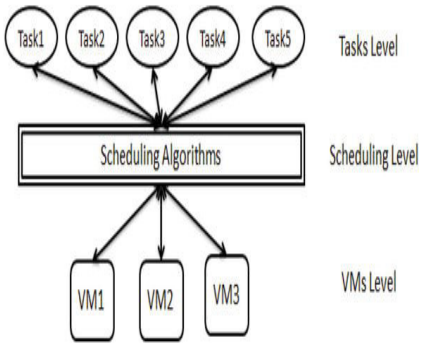


Figure 3.1 : Task Scheduling in Cloud Computing

The primary goal of the task scheduling algorithm works in achieving two main roles especially in minimizing the energy and make span. These tasks could be categorized as follows:

- Independent: It does not require any sort of communication among the tasks.
- Dependent: A specific order should be maintained among the task during the scheduling process.
- The scheduling algorithm is categorized in two types:

- Static scheduling: before the execution, the scheduled task analyzes execution/run time of the complete task structure with the resource mapping format.
- Dynamic scheduling: scheduling decision is made by the computer machines by submitting the task to the cloud environment, which is performed based on the current status of the system.

The static strategy is carried out by the following manner:

1. **Algorithm based on the heuristics:** This algorithm follows realistic assumptions about appropriate knowledge concerning process and loading characteristics of the system, but it does not provide an optimal solution. It does not provide an optimal solution. The algorithm runs with estimated cost functionand progress with the other system resources to enhance their functionalities.
2. **Algorithm based on the guided random search:** This algorithm works by making a search around the nearoptimal solution in space and Genetic algorithm is said to be one among its type. The guided random search algorithms make an exact similarity with the things existing in nature and it is also known as nature's heuristics". The optimal solution is enabled by making a choice in a random manner around the problem space in a guided manner.

3.2. Identification of ant Colony Algorithm

The colony of Ant has a territorial structure of nature and practices indirect contact phenomenon, also known as stigmergy. In addition, direct contact may also be observed from ant to in the form of antennation. In the sense of a decentralized approach to mission management and large numbers of individuals, we might anticipate a high degree of parallelism, fault tolerance and self organization from the studied species via the ant colony [25] We will be able to obtain a high amount of inspiration in meta heuristics by understanding these paradigms as shown in Figure 3.2. In the section below, detailed knowledge of the metaphors of the ant colony has identified [26].

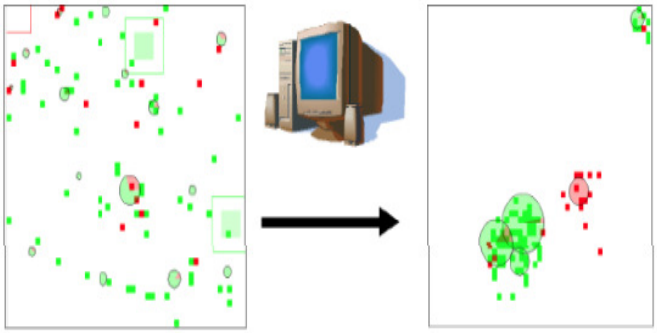


Figure 3.2: Ant Colony-inspired technique

Green represents type of beats as two types of beats while red represents ventricular which are distributed stochastic over the 2D plane [27] The large species of ant workers are asked to clean up their nest by creating the stacks of corpses. This phenomenon of aggregation occurs due to the mediation of attraction among the dead items. The greater likelihood of deposited work is equivalent to large objects, and these objects, and these objects occur within the range of perception. The Messor sancta ants, for example, work to shape a cluster of dead bodies in the ant's colony of Leptothorax antifascists, the study of brood sorting is carried out. Data cluster created by [28] M.A. Porta Garcia et al 2009 have established this technique. The clustering technique used is highly receptive to both the methodology of similarity and the perception spectrum of agents. A point to be remembered is that the pheromone is not used in this technique.

There is also a form that uses pheromones, namely, A2 CA. The role of [29] L. Gao al 2008 deals with another method known as the ATTA algorithm that initiates the alternative function of the neighbourhood (Complete dissimilarities are penalized), complete perception radius, looked at with short-term memory (jumping ants) and neighbourhood modulated time-dependent function.

3.3 Optimization Algorithm Using Modified Ant Colony Algorithm

Function optimization implemented by [30] and several other applications, such as optimal paths [31] scheduling, [30] biomedical data processing and classification, 2000 image and data analysis, and many more, using the swarm intelligence, several other developed applications have drawn inspiration from the natural behaviour of different organisms.

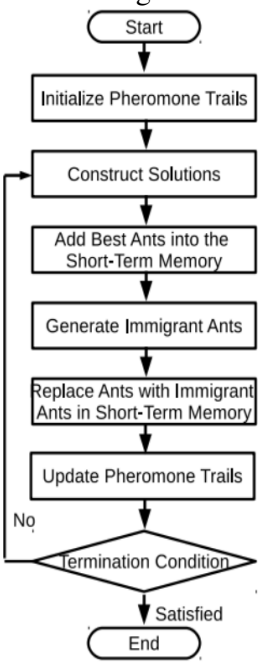


Figure 3.3: ACO Flowchart

Many biologists were inspired by these ant colonies and the researchers were encouraged to construct an algorithm based on the ant called the algorithm inspired by the ant colony. The ant metaphor has developed several algorithms such as clustering and continuous optimization as well as static and dynamic combinatorial optimization. By considering a linked graph consisting of many assignments, we can create an artificial ant based on the properties. Starting from its beginning task, the ant is made to walk on the arcs and travels on every step to the neighboring task and it continues until it finds a food source task. To build its self-pheromone on the arcs, the artificial ant can be programmed to “red” and “write”.

4. Implementation and Evaluation

The dataset log includes 11 operation days from various Large Hardaon Collider Computing Grid node as shown in figure 4.1 As mentioned in the accompanying document. The MaxProcs noted in the log is the total number of process on the grid. This does not actually represent the nodes in the log which were accessible and used by the workers. In addition, the log only contains jobs submitted through the resource brokers of the grid and does not include load generated locally. The estimate of device efficiency is thus inaccurate. The name of a group is encoded as follow:

NUMBER	NAME
1	hcl
2	atlas
3	fusion
4	cms
5	zeus
6	dtem
7	genat
8	hone

9	dcms
10	hone
11	see
12	phicos
13	ilc
14	ibm
15	cloud
16	biomed
17	rgstest
18	ncf
19	vlic
20	accer
21	fusion
22	pvier
23	babar
24	photon
25	hungrid
26	velfi
27	pheno
28	ncf

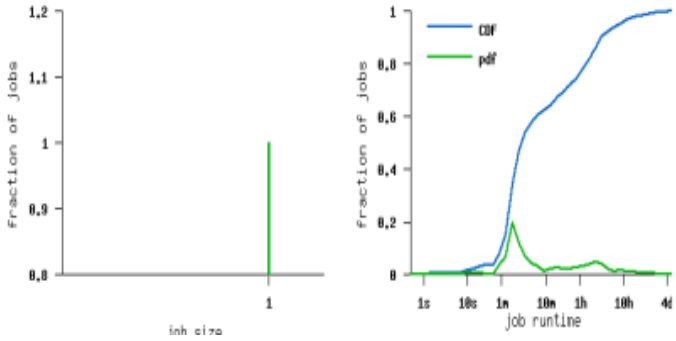


Figure 4.1: Task arrival

By employing java programming language for implementation ant algorithm. To evaluate the shortest food spot, the ant object consists of attribute and position as well as Boolean values. Users send resource brokers for serial or concurrent work. To carry out the calculation, the resources brokers find sufficient tools,and submit processes for execution on the various networks. The log is at the level of specific processes, and does not contain details on which processes might be part of the same parallel job. A side effect is reports all workers (processes) as having a scale of 1.

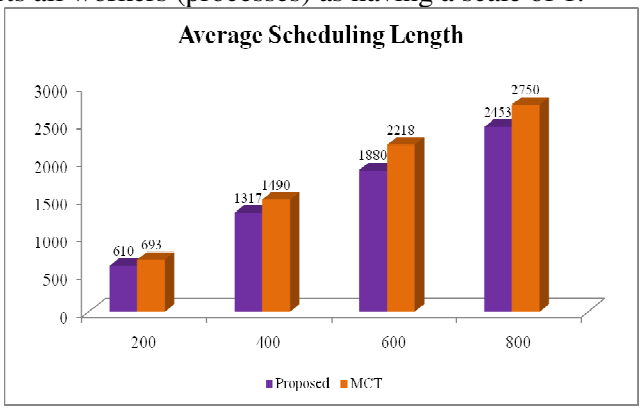


Figure 4.2: Task arrival

5. Conclusion and Future Enhancement

To establish and facilitate a scheduling management system for the deployment of cloud computing engineering, the essential implications of cloud computing technology resource management know as task scheduling have parsimoniously clarified. The primary function of cloud computing is to allow customers to schedule tasks optimally with the least running time, to achieve load balancing with the highest level of service. The main purpose of task planning algorithm is to achieve these essential objectives effectively, namely, task planning enables physical device make-up and resource to be reduced. A promising platform that can offer on-demand software over the internet is cloud computing. However, when it comes to deploying effective resource allocation systems, there is significant disagreement. The allocation of resources has provided various advantages, especially for Infrastructure as a service cloud computing, as resource allocation uses virtual machines to meet the demands of cloud customers. To develop and promote a schedule management framework for implementation of cloud computing engineering, the basic implications of cloud computing application resource management known as task scheduling have been parsimoniously explained. The primary function of cloud computing is to allow customers to plan activities optimally with the least running time, to achieve load balancing with the maximum quality of operation.

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