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A Hybrid ABC-WOA for Virtualization in Cloud computing

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Abstract: The virtualization method is an essential technique in cloud computing for reducing the power utilized by the cloud data centre. The majority of services in this generation are going to the cloud, which has raised the demand on data centers. As a consequence, the data centre expands in size, which increases energy usage. A resource allocation optimization technique must be effective in order to handle this problem. This study suggests a hybrid approach for allocating VM depend on ABC-WOA, which is a type of supervised ML method. With better load allocation across the available resources and a focus on resource utilization, the project's objective is to use less energy. In order to create a training database for the WOA method & ultimately obtain a trained design, the suggested approach utilized an ABC. The outcomes demonstrated that the suggested ABC-WOA model outperforms the current models in terms of energy consumption, execution time, & resource utilization of the data centre and hosts. Performance measurements for the task consisted power consumption, execution time, resource utilization, average start time, & average finish time.

***Index Terms* – Cloud Computing(CC), Virtualization, Dynamic Resource Allocation(RA), Virtual Machine, ABC,WOA.**

I. INTRODUCTION

The phrase "cloud computing" refers to a substitute for all the computer hardware and software that each user uses, including that which exists on your desktop or somewhere else in your company's system, and that is offered to you as a service by another business and obtained over the Internet, usually in an entirely uniform manner. The user doesn't care exactly where the hardware & software are found or how everything works because it's currently somewhere in the mysterious "cloud" that the Internet symbolizes.

Although the word "cloud computing" is often used, different people associate it with different things. For some, it's just another way to describe IT "outsourcing"; for others, it refers to any computing service delivered over the Internet or a comparable system; & for others, it refers to any computer service you purchase and use that is located outside of your firewall[1]. However, when authors explain CC, it is clear that looking at some simple, practical examples rather than discussing abstract notions would make more sense, so let's limit our discussion to those.

IT experts talk regarding three different types of cloud computing where different services are offered to you. There is some overlap among these topics as well as a degree of vagueness in how they are described. IaaS, SaaS, and PaaS are the three. Cloud services could be ordered on-demand and are frequently paid for on a subscription or "pay-as-you-go" basis. In the same way that users would buy power, phone service, or Internet access from a utility provider, we typically buy cloud computing. Cloud computing can occasionally be used for free or for a fee in various ways. User can buy as much or as little of a cloud computing service as you require to begin with one day then onto the next, much like you can with energy. Cloud computing is the use of software networks and data centre servers to execute applications for remote end users or dynamically allocate resources[2]. Cloud deployments, which are typically categorized into three categories (private, public, and hybrid), have rapidly expanded in recent years, promising financial savings & greater adaptability compared to conventional private data centers.

One of the key techniques utilized in CC is virtualization. Cloud designs offer on-demand systematized resource allocation and quick scalability of the actual servers to run one or more VMs on demand.

The allocation of a cloud provider's resource to a customer is known as cloud provisioning. When a cloud provider agrees to a customer's request, it must build the necessary set of VMs & assign resources to support them. This is how dynamic provisioning, user self-provisioning, and advance provisioning are carried out. Provisioning simply means "to provide" in this situation. With advance provisioning, the client makes service commitments to the provider, and the provider makes the necessary preparations before the service is launched. The client is either billed in a lump sum or on a monthly basis. When using dynamic provisioning, the provider assigns additional resources as required & assigns them as they become unnecessary. Pay-per-use billing is used to charge the customer. Cloud bursting is a term that is sometimes used to describe the process of using dynamic provisioning to build a hybrid cloud.

In order to solve numerical issues, Karaboga invented the ABC approach in 2005 [3]. It is a algorithm based on that was inspired by the bees' logical approach to food selection. The algorithm considers the food sources as solutions. In this procedure, there are 3 different kinds of bees. The first are the hired bees, whose job it is to look for new solutions (food) close to the ones that are already in place. The second kind are the spectator bees, also called the idle bees. The employed bees share their solutions with the observer bees. The observer bees use probability to select their answers. Another kind of unemployed bees is the scout bees. If their solutions cannot be further improved after several tries, employed bees become scouts. When the solutions are no longer needed, the scout bees begin looking for replacements. The method is divided into four stages: initialization, employed bee solution search, onlooker bee solution search, and scout bee solution search.

WOA is an intelligent system based on swarms that fixes problems in continuous optimization. It has been demonstrated to have high outcomes using new meta-Heuristics techniques. In comparison to other swarm intelligence systems, it is easy to construct and robust, making it similar to a number of nature-inspired techniques. One controller variable (time interval) requires to be adjusted for the approach.

The humpback whale population in the WOA explores a multidimensional search space in quest of food[4]. The goal cost value is connected with both the available food and the separation among the humpback whales, so each humpback whale position is represented by a separate choice factor. Be aware that three functional sections dictate a whale's location throughout time:

(1) Shrinking encircling prey,

(2) bubble-net attacking strategy (exploitation phase),

(3) Hunt for prey (exploration phase).

The following is how the paper is set up: Section II presents the literature review, and Section III discusses proposed work. Section IV shows the results and discussions. Section V wraps up the paper by presenting optimization strategies for dynamic resource allocation.

II. LITERATURE REVIEW

Vadivel et al. [5] proposed enhanced HPSO-MGA to provide a dynamic resource allocation mechanism that disperses work or requests across virtual machines. The rule generation procedure also evaluated the feature outcome. The user or consumer starts the process by gathering data from numerous online resources. Task Manager will receive these data. Authors can extract parameters from the task manager such as the task's cost, speed, data size, weight, etc. Similar to this, may collect information from the cloud storage about system resources like CPU Utilization, Memory Usage, Processing Speed, & Process Cycle, Bandwidth, Set of Requests, load on VMs, and Disc space. To reduce the processing time needed for dynamic resource allocation, Hybrid PSO and Modified Genetic Algorithm (HPSO-MGA) is used here to choose the necessary features. Only essential features will be used out of all the features. As a result, resource allocation takes less time and is less accurate. As a consequence, the execution time of the suggested HPSO-MGA is decreased while resource allocation performance is improved. When compared to the current approaches, the performance of our proposed RA methodology is superior.

Chhabra et al. [6] created the concept of choosing the best host allocation plan that could minimize energy usage and increase resource utilization. For parallel & distributed applications, we provide an Optimal VM Placement for Load Balancing (OPLB) employing Maximum Likelihood estimate. In order to account for increases in throughput and failure rate, the problem is phrased in a speculative paradigm based on CPU, Memory, and Energy predictions. The performance evaluation shows that the suggested method significantly outperforms the sequential, random, and LB-BC virtual machine placement heuristics in terms of traffic scalability by up to 49.54%, 32.63%, and 19.23%, etc.

Shen et al.[7] In order to enhance overall load balance performance and obtain higher adaptively, the optimization issue of the ABC depend on load balancing method is suggested in this work. The ABC technique is optimized and the smart grid cloud sources properties are employed to cluster VM. Simulation analysis verifies the suggested method's efficacy.

R Pushpa et al.[8] For VM optimal positioning in cloud environments, the ABCSO approach has been proposed. By incorporating the adaptive concept into the conventional ABCSO approach, the developed Adaptive-ABCSO is created. By merging ABC with CSO, the classic ABCSO algorithm is created. Additionally, the suggested strategy has produced low power consumption of 0.042, minimum load of 0.165, and minimal migration cost of 0.055.

Girish Kalele et al. [9] provided a Secured Dynamic Priority Weighted Scheduling technique that utilizes Virtualized Subnet Transmission Support Factor. Additionally, Secure Time variant Traffic evaluation, packet transfer on networks with virtualized security, and cloud scheduling procedure are all improved by Secure Time. In comparison to the alternative system, the suggested enhances scheduling efficiency as well as the security and trust aspect.

Kaur et al.,[10] Hybridising the Ant Min-Max method, Ant Colony Optimisation approach, and Genetic method to create an efficient load balancing system. Costs associated with the CPU, RAM, configuration time, and travel distance are some of the efficiency variables. According to the simulation's findings, using virtual migration in the suggested work is preferable to using other rules since it least violates the SLA & the set of migrations. The SLA in this study is calculated by dividing the total amount of VM migrations by the amount of host machines along with by the amount of iterations. ACO-VMM (base paper) & the suggested method have been compared based on cost, which is a prevalent aspect of live migrations.

Dhiraj Singh et al. [11] implemented the Targetive dynamic secured resource allocation (TDSRA) method, suggest a virtualized secure cloud computing system. Load-balancing technique is used in distributed computing to improve resource utilization security in computer systems. Particularly, rather than problems like energy economy, throughput, or resource planning, the emphasis is on enhancing virtualization app planning relative to other platforms or boosting cloud user security effectiveness.

Praveenchandar et al. [12] suggested that an efficient dynamic resource allocation technique use enhanced job scheduling & an ideal power minimization method. It is possible to attain efficiency in RA in regards of job completion & reaction time by utilizing a prediction method or a dynamic resource table update method. This structure lowers the power usage in data centers, which produces an efficient result with regard to of power reduction. The suggested approach presents precise values for changing the resource table. A more efficient job scheduling method & decreased power consumption strategy result in efficient resource allocation. When compared to other methods currently in use, a simulation result produces outcomes that are 8% better.

Boonhatai Kruekaew et al.[13] It is recommended as an independent task scheduling technique in cloud computing to use a multi-objective task scheduling optimization based on the ABC with a Q-learning technique, which is a reinforcement learning technique that speeds up the ABC algorithm. By maximizing VM throughput, scheduling efficiency, or load balancing between VMs based on make span, cost, and resource utilization, the recommended strategy aims to get around the limitations of concurrent issues. Efficiency investigation of the suggested approach was carried out in three datasets—Random, GoCJ, and Synthetic workload—using CloudSim and the load balancing & planning techniques already in use—Max-Min, FCFS, HABC_LJF, Q-learning, MOPSO, and MOCS. According to the experimental findings, MOABCQ-based algorithms beat other approaches by means of lowering make span, cost, degree of imbalance, boosting throughput, or utilizing resources on average.

Savitha et al.[14] provided the P-PAVA approach, a perceptive priority aware VM allocation policy that takes into account an application's priority as well as its measure, memory, and bandwidth requirements. Using a ML-based prediction model, the programme distributes the applications according to the priority it receives. Additionally, parallelization is utilized before allocating distinct workloads in way to lower the overhead of the allocation method. The method uses the First fit method as a baseline for the requests allocation with a less priority criterion in order to accomplish this. PPAVA outperforms the most recent approach for VM allocation for priority aware apps in terms of a number of metrics, including average response time, execution time, & power usage.

Vikrant Sharma et al. [15] By utilizing the enhanced emperor penguin optimization technique, authors offer a revolutionary method for assigning VM to satisfy the demands of specific consumers. Focusing on tried-and-true optimization approaches for effective VM allocation further highlights the benefit of the proposed strategy. The Java programming language was used to create this application, which was then installed on the Netbeans IDE 12.4.

III.PROPOSED WORK

- Problem Statement

Most intelligent devices are highly interested in the placement or diagnosis issues [20]. In this work, we took into account the network connections between several PMs in cloud datacenters. They are allocated to a number of VMs that are running various apps. The diagram for the VM allocation issue is shown in Figure 1. In order to achieve the goals of this task, namely durability, maximising resource utilisation, and minimising power consumption, n VMs with the various necessary resources have been assigned to suitable m PMs. The resource kinds that every PM offers are CPU, network bandwidth, and memory. The resource requests from VMs and the resource abilities of PMs are often different. As seen in Figure 2, the Av allocation outline can be represented as a vector in which the PMs are represented by the components, and the VMs are represented by the elements' values.

Energy consumption model

Server energy consumption is determined by a linear relationship among CPU usage & energy use. Thus, Equation (1) is used to determine the VMs' CPU utilisation.

$$CPU_{Vm,i} = \frac{VM_{mips,i}}{Host_{mips,j}} \quad (1)$$

In Equation (1), mips VM , i represents the needed for VMi , and Hostmips j , , the whole capacity of PM j . Also, CPUVm i

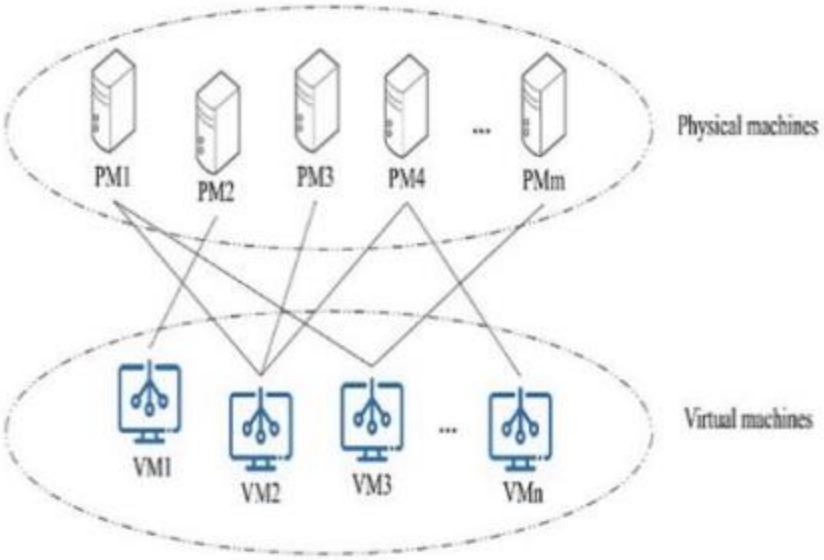

Figure 1: Diagram of VM allocation problem

1	2	3	4	5	6	7	8	9	…	n
15	2	14	23	6	36	4	1	17	…	m

Figure 2:An array of VM allocation solution

shows how much CPU time VMi is using. Equation (2)'s compilation of the PM j i scale's CPU use. Equation (3) is also used to compute the energy consumption of PM j as a function of CPU usage. Pj is the power consumption (Watt) of PM j at the moment, Pidlej is the power consumption (Watt) of PM j when it is idle, and P busy is the maximum power consumption (Watt) of PM j when the CPU is fully utilised.

$$CPU_{Host,j} = \sum_{i \in rj} CPU_{Vm,j} \quad (2)$$

$$P_j = \{(P^{busy}{}_j - P^{idle}{}_j) * CPU_{host,j} + p^{idle}; CPU_{hostj} > 0 \quad (3)$$

The amount of energy used of all relevant hosts in the issue must be taken into account when calculating the system's overall energy consumption during VM allocation. As a result, the primary goal of the strategy presented in this work is to reduce the energy consumption of PM as determined by Equation (4).

$$Energy = \sum_{j=1}^{M} P_j = \sum_{j=1}^{M} [(P_j^{busy} - P_j^{idle}) * CPU_{host,j} + P_j^{idle}] \quad (4)$$

The situation in Equation (5) must be taken into account in Equation (4). If VMi may be assigned to Pmj, it is indicated by the binary variable xij. The parameter xij will have a value of 1 if the VMi is allocated to the Pmj and a value of 0 otherwise. When Pmj's available assets exceed VMi's minimal needs for resources, VMi usually allocates them to Pmj.

$$\sum_{i=1}^{M} x_{ij} = 1 \quad \forall i \in N \quad (5)$$

Allocation time model

Optimising the time needed to assign VMs to the right hosts is another objective. The hosts' capacity determines how long it takes to complete the allocation process. As a result, for every source, the information set needed for the time variable is created statistically at random between 0.1 and 10 ms. The time associated with the participating hosts in the procedure must then be added together in accordance with Equation (6) to determine the total allocation time.

$$Time = \sum_{i=1}^{n} T_i \quad (6)$$

- Objective

The following are the objectives of the study:

- To develop a hybrid ABC-WOA algorithm for VM resource allocation in cloud computing environments.
- To evaluate the performance of the hybrid algorithm on a variety of VM resource allocation problems.

- To contrast the conductance of the hybrid ABC-WOA approach with the current algorithm.

The Hybrid ABC and WOA algorithm is a combination of two different optimization techniques: the ABC algorithm and the WOA algorithm. Both ABC and WOA are nature-inspired optimization algorithms used to solve complex optimization problems. The hybrid approach aims to combine the strengths of both algorithms to improve their efficiency in fixing specific optimization issues.

In the context of CC, VM resource allocation is a critical task to ensure efficient utilization of cloud resources. The hybrid ABC-WOA algorithm can be applied to fix the optimization issue of allocating physical resources to VMs. The algorithm uses a combination of artificial bee colony and whale optimization techniques to find the best allocation strategy that minimizes costs, maximizes resource utilization, and meets performance requirements in a cloud environment.

Developing a hybrid ABC-WOA (Artificial Bee Colony-Whale Optimization Algorithm) for VM resource allocation involves several steps. Figure 3 discusses a step-by-step guide to developing a hybrid ABC-WOA algorithm for VM resource allocation.

Figure 3: Steps for Developing a Hybrid ABC-WOA Algorithm

IV.RESULTS

As cloud computing has grown, consumers have come to understand that while it offers convenience, it also consumes a significant amount of energy when compared to more conventional service models. Currently, certain suppliers can adapt to dynamic modifications to user needs in order to meet user requirements. Yet, in the real world, this will result in a significant loss of resources and a rise in unneeded energy use. The application load request resources will fluctuate in accordance with changes in user demand. So the question of how to cut energy use while maintaining service quality needs to be addressed. By correctly distributing VM resources on physical nodes in a cloud computing environment, the best VM resource distribution technique can significantly reduce energy consumption.

Due to the fact that there are two goals for optimization, both of which must be minimized, we presented an ABC-WOA technique in this study. These two variables cannot be mixed because they utilize distinct units. Thus, these numbers need to be normalized and summed using the user's priority coefficients in order to determine the value of fitness. It is necessary to determine the coefficients so that their sum is equal to (1(2i=1wi=1)). Equation's final value is discovered. The two variables of time and energy are taken from the prior formulas, normalized, and added by the aforementioned coefficients (w1&w2), yielding the final fitness, in this equation.

$$Fitness = w_1 * Energy + w_2 * Time \quad (7)$$

$$Energy = \frac{Energy_{max} - Energy}{Energy_{max} - Energy_{min}} \quad (8)$$

$$Time = \frac{Time_{max} - Time}{Time_{max} - Time_{min}} \quad (9)$$

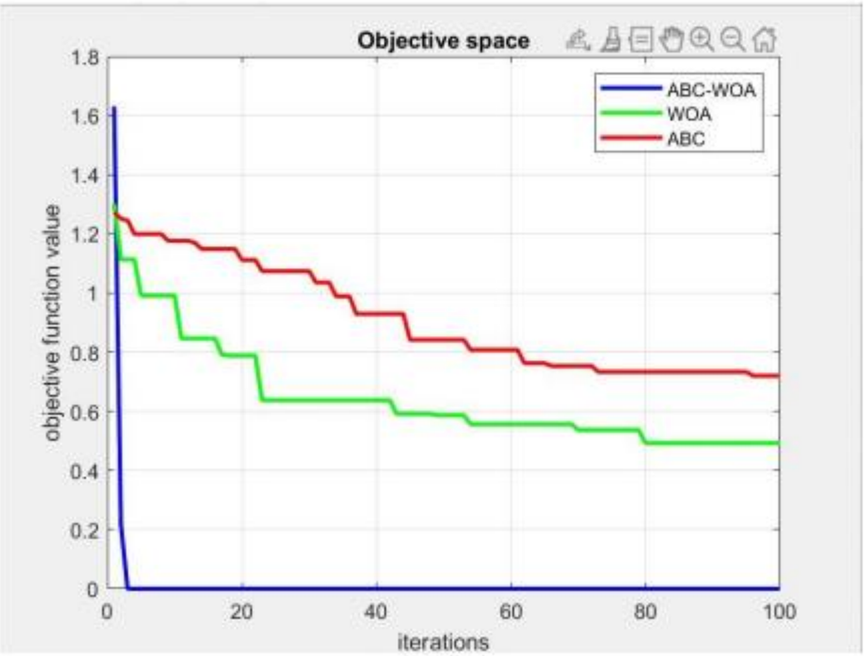

Figure 4: CONVERGENT PLOT

The convergent plot comparing hybrid ABC-WOA, WOA, ABC 100 iterations shown above reveals that, when compared to other existing modes, our suggested Hybrid ABC-WOA saturated at 2 iterations to 100 iterations, resulting in less aims space when compared to others.

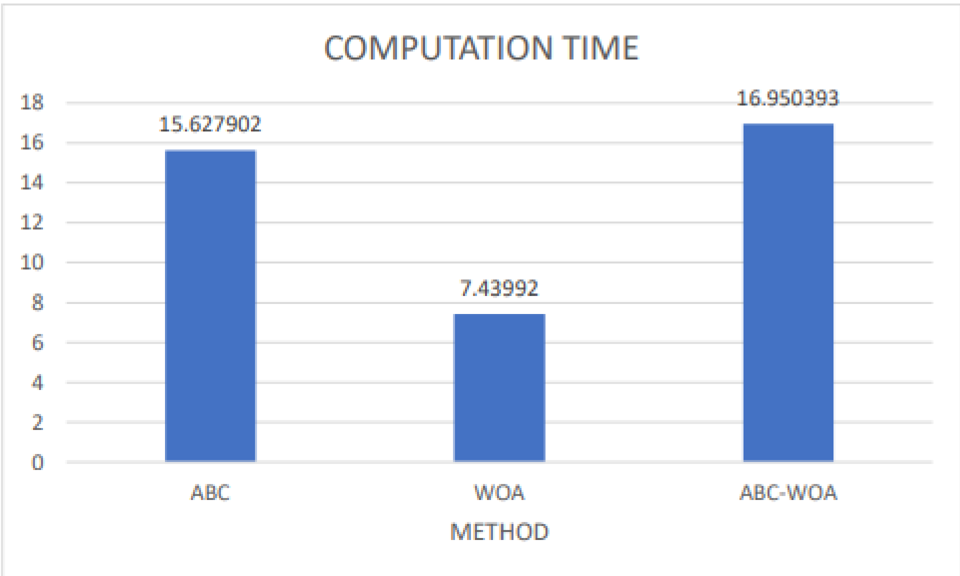

Figure 5: COMPUTATION TIME

The figure 5 presents computation times for different models: ABC (15.63 units), WOA (7.44 units), and ABC-WOA (16.95 units). It's evident that ABC-WOA exhibits a slightly time delay in processing compared to ABC and WOA, as indicated by the figure. This information highlights the relative efficiency of these models in terms of computation time

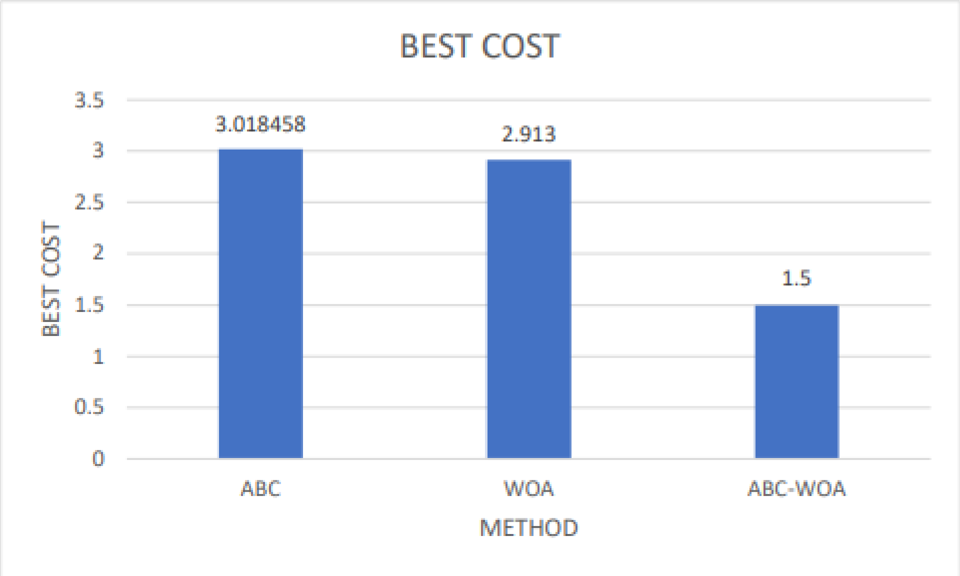

Figure 6: BEST COST

The figure 6 prominently displays the optimal cost outcomes for distinct models: ABC (3.018), WOA (2.913), and ABC-WOA (1.5). Notably, ABC-WOA excels, demonstrating its exceptional efficacy in minimizing the objective function when compared to ABC and WOA, making it the standout performer.

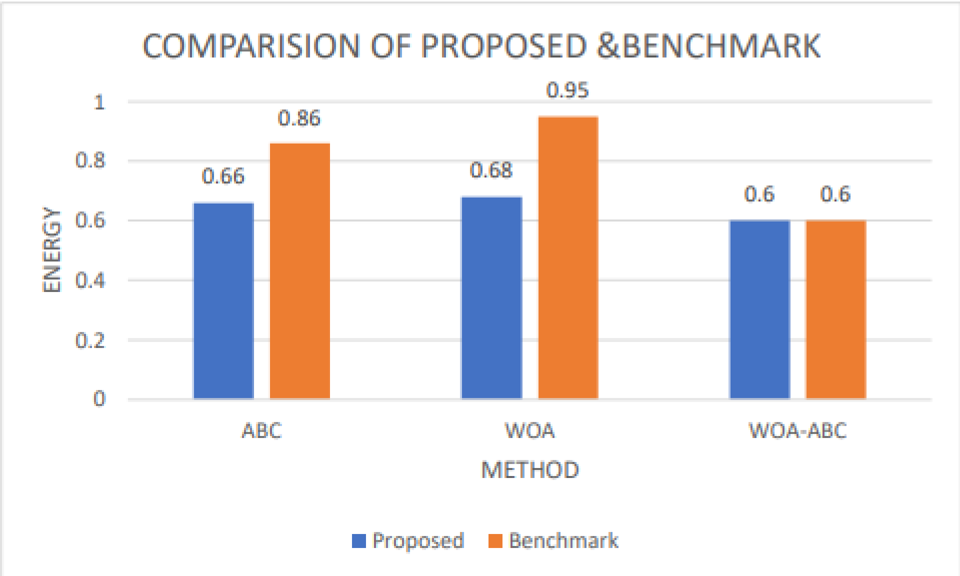

Figure 7:COMPUTATION OF PROPOSED &BENCHMARK

In the depicted figure 7, a compelling comparison between the proposed ABC-WOA model and the established ABC and WOA models is evident. Notably, the ABC-WOA model showcases outstanding energy efficiency with a score of 0.6, outshining the performance of ABC (0.86) and WOA (0.95). These scores serve as benchmarks, unequivocally highlighting ABC-WOA's remarkable effectiveness in optimizing energy consumption, underscoring its potential to substantially improve energy efficiency in practical applications.

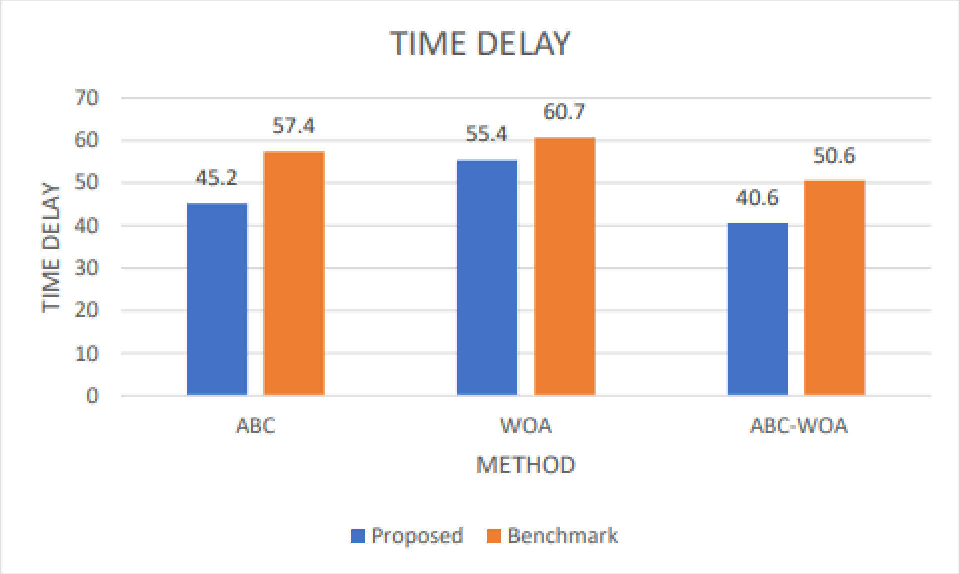

Figure 8: TIME DELAY

Based on the ABC-WOA diagram above and existing models such as ABC, WOA. It is clear that the planned ABC has a total energy of 45.2. When compared to other available methodologies, WOA is 55.4. ABC-WOA is 40.6, whereas ABC is 57.4, WOA is 60.7, and ABC-WOA is 50.6.

V. CONCLUSION

One of the key determinants of efficient and affordable resource processing in infrastructure as a service Clouds is resource allocation. Maximizing the use of physical resources is very important, despite the fact that supplying an efficient resource allocator is difficult. The placement of the chosen virtual machines on the accessible physical machines, particularly for the advanced reservation request approach, has received less attention than the optimization of VM selection for migration. The hybrid ABC-WOA algorithm is presented in this study as a useful method for allocating VM resources in cloud computing environments. The approach outperforms other cutting-edge algorithms and can effectively solve a range of VM resource allocation challenges. The hybrid algorithm is a viable option for real-world apps because it is also fairly simple to set up & operate.

The approach may be utilize to fix other optimization issues in CC & can be further enhanced in the future by combining additional search techniques. Additionally, there is a chance to advance the method by putting it to use on a genuine cloud computing platform and putting it to the test with real-world data.

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