An efficient Task Scheduling Algorithm using Modified Whale Optimization Algorithm in Cloud Computing

N.P.Saravanan, T.Kumaravel

Abstract: Cloud computing brings computing resources such as software and hardware, it serve service to the users through a network. Major concept of cloud computing is to share the marvellous storage section. In cloud computing, the user jobs are prepared and executed with appropriate resources to successfully deliver the services. There are large amount of task allocation techniques that are used to accomplish task planning. In order to improve the task scheduling technique, so we proposed method of efficient task scheduling algorithm. Optimization techniques are solving NP-hard problems is very famous. In this proposed technique, user tasks are stored in the order of queue methods. The priority is designed and allocated suitable resources for the task. New tasks are investigated and kept in the on-demand priority of queue. The output of the on-demand queue is given to the MWOA. It has been proved that this algorithm is capable to eliminate optimization problems and outperform the current algorithms. The method is proposed to the required more number of iterations is reduced. The proposed algorithm is compared with various scheduling algorithms such as, genetic algorithm, ant colony, standard grey wolf optimization and particle swarm optimization. The outcomes of tests indicate the better efficiency of the MWOA in expressions of makespan and energy consumption.

Keyword: In cloud computing, the user jobs are prepared and executed with appropriate resources to successfully deliver the services.

I. INTRODUCTION

Distributed computing is an on-request administration that has gotten mass intrigue in corporate database. CC empowers organizations to expend PC assets like VM, stockpiling, as an utility and keep up the foundation [1]. CC can give least cost, high caliber, adaptable and versatile administrations to administrators [2]. CC administrations are IaaS, PaaS, and SaaS to clients. CC can be private, open, and half and half cloud [3]. Single mists are progressively powerless against disappointment of administrations less accessibility and malevolent insiders. Numerous association embraced to multi-cloud for dropping the disappointment of administrations. Multi-cloud is the blend of open, private or oversaw mists including administration providers [4]. Multi-cloud information framework upgrades information sharing and serves to the clients significantly.

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Actualize the Task booking to sound sending of assets face the client needs while augmenting the money related benefits of CS suppliers. As a help plan of action, task planning plans in mists are expected to go over the QoS necessities of client assignments, which involve cutoff time, makespan and cost of cash [5-7 some equipment stages has unsatisfactorily coordinating application can debase the entire execution of mists and may disregard the QoS ensures need that numerous client errands [8]. There are various traditional booking calculations as FIFO. Framework is unimaginable on the grounds that it fundamentally needs to shape each likely errand schedulers and match them with one extra to find the best arrangement which would net heaps of period[9,10]. The significant guides of this paper are as given beneath:

- ❖ Formulate the makespan through mathematical models for optimal task scheduling and reduce the consumption of energy as the objective functions.
- ❖ MWOA was develop for optimum task scheduling in IaaS cloud computing.
- ❖ Implementation of the MWOA in CloudSim simulation tool.
- ❖ Comparative and statistical analysis of the Modified-MGWO algorithm with current meta-heuristic algorithms for task scheduling in IaaS CC.

The rest of this investigations is requested as: In Section. 2, audit the present assessment based related examination works for TSA in the zone of IaaS distributed computing. System of Task Scheduling is talked about in Sect. 3. The paper gives the depiction of MWOA in Sec. 4. Area 5 shows the outcomes and talk of proposed strategy with the assistance of exploratory examination. The last area is Sect. 6, which comprises of subtleties of the end, suggestion and future works.

II. LITERATURE REVIEW

In this part, the exchange of existing methods are exhibited, which are makes to protect the information in distributed computing. The points of interest and impediment of the current systems are likewise examined from [11-16].

Kan Yang and Xiaohua Jia., [11] structured an inspecting system for information stacking in CC. This structure stretched out to permit information dynamic help assignments and group evaluating for every two a few holders and compound mists without utilizing legitimate coordinator.

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This strategy was proficient, correspondence cost and calculation cost is extremely less, and improved the reviewing execution. The drawback was inspecting structure in cloud will in general consume more memory space.

Kan Yang and Xiaohua Jia., [12] built up a revocable information get to control conspire by multi authority CP-ABE for multi distributed storage frameworks. Both front and rear care in cloud framework is accomplished by characteristic renouncement strategy. The repudiation technique checked that the plan was exceptionally verified in arbitrary prophet model. In remote stockpiling plans multi authority CP-ABE strategy was applied. The impediment of the CP-ABE was capacity overhead, uncommonly when the whole of figure content was tremendous in distributed storage framework.

Rashmi Jogdand., et al., [13] guaranteed information respectability with open undeniable nature and accessibility. This strategy ensured information accessibility by receiving Deep Sky System exemplary for multi-mists. This multi-distributed storage made document access by transmitting the connection as single time download for different clients. The documents were empty for the other legitimate clients in the record framework. The disservice was inertness of the scattered pieces over various servers on the cloud was extremely high.

Liangmin Wang., et al., [14] built up a database called SHAMC condition. The database was set up to help to deal with all requests in TPC Benchmark H (TPC-H). In this database, the homomorphic encryption was executed the inquiries direct on the figure content. The bit of leeway was administration interference was stayed away from in increasingly number of cloud and the database broke changeless disappointment issues and seller lock-in. During the database outstanding tasks at hand test Sysbench, numerous gridlocks had occurred. This proposed database was the most significant hindrance.

J. A. J. Sujana, et al., [15] proposed a SPSO strategies, which protected booking based to design the advanced timetable with perform of makespan and ease. The strategy was equipped for handover the errand in the logical work processes to the best appropriate successful machine in the cloud. Plus, a variation of PSO calculation called Variable Neighbour-hood PSO was likewise attempted to conquer the nearby optima issue. The yield results demonstrated that the booked work processes with guaranteed security were yield much preferred makespan over existing techniques with least emphases, in cloud condition is very appropriate. The SPSO calculation bit by bit builds the vitality cost go in heterogeneous condition.

G. Natesan, and Arun Chokkalingam, [16] has proposed a multi-target parallel machine booking procedure dependent on the OGWO. Premise cost and time model on distributed computing condition is limit. Moreover, the possibility of restriction based information is utilized with the standard GWO. To improve its computational speed and union profile of the proposed technique. This strategy surpasses among all methodologies and conveys quality calendars with less measure of memory usage and calculation time too. Be that as it may, OGWO approach takes more effort for mapping the undertaking to physical machines.

Task Scheduling

Task scheduling is a formula used to allocate received tasks to the accessible resources. Foremost aim of TSA is to make the most of the resources utilization without any affecting the service parameters side of the cloud. Figure 1 shows the whole energy aware task scheduling framework. This is collected of 4 important modules: user portal, task scheduler, information service and cloud data centre with PM [17-18]. Information providing process is the initial process, in which the task scheduler gathers task information. Task and the resource manager side to the Resources information. Selection process is the second step, in which the target resource is designated based on definite parameters of the resource and the task. Limitations contain task priority, task size, of the tasks. Then, transfer the task allocation plan to the resource manager by task scheduler. The final process of these system is the task distribution. In this step, each task assigns to the appropriate resources by the task manager.
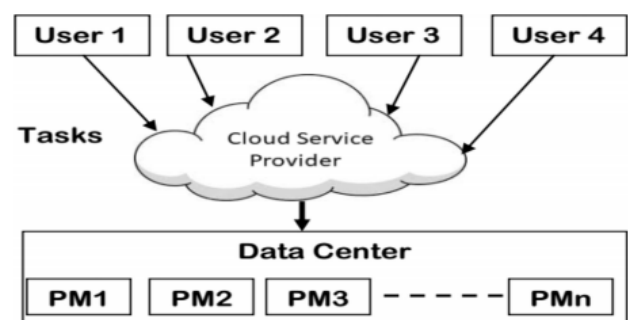
Figure 1: Task Scheduling in Cloud environment

Computing efficiency degradation cause scheduling a lot of tasks. That leads to long makespan, wait times problem, and costs problem. Therefore, the problematic of optimal allocation of a more number of tasks to the offered VMs is a better challenge. Cloud computing Scheduling in is noted as an issue with a large solution space [19, 20]. Thus, it takes a much time to discover an optimal solution. Implement more easily and fastest algorithm is Deterministic scheduling algorithms because every designed on one or a limited rules for handling and ordering the tasks. However, these not able to discover the optimal solution in an equitable period of time, especially when the issues becomes difficult or the number of tasks is much big. In contrast, metaheuristic-based performances have been verified to achieve near-optimal solutions within a correct time for such problems. Metaheuristic-based algorithms normally offer good results than deterministic algorithms. Therefore, in this research work, MWOA is used for effective and efficient task scheduling in cloud computing, which is detailed in below division.

III. PROPOSED METHODOLOGY

WOA is a directly arranged stochastic streamlining calculation. For enhancement issues to decide the worldwide ideal of populace search operator. Moreover to other populace based calculations, discovering techniques starting with making a lot of arbitrary answers for an expected issue.

It by build up this set until the satisfaction Fig. 2. WOA and others between significant varieties decides that recoup the applicant arrangements of enhancement in every progression. WOA the conduct of chasing bump back whales in revelation and hostile quarries as air pocket net encouraging conduct. This model is uncovered in Fig. 2. It might be conceivable to note in this figure a humpback whale produces a snare with running in a winding manner round preys and creating round air pockets close by. The significant motivation strategy for the WOA is the shrewd scavenging. Another reproduced conduct of humpback whales in WOA is the encompassing system. Moving Humpback whales around the hover preys to bubble-net instrument utilized start chasing them.
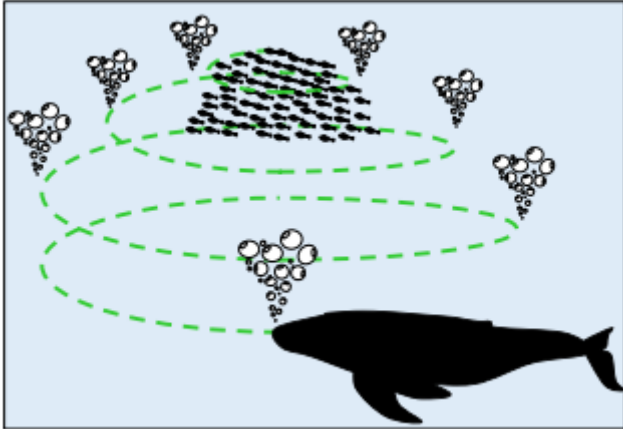

Figure 2: Hunting Behavior of Bubble-Net

(Mirjalili and Lewis in 2016) has present WOA. The major calculated equation defined in this algorithm is as follows

$$X(t+1) = \begin{cases} X^*(t) - AD & p < 0.5 \\ D'e^{bl}\cos(2\pi t) + X^*(t) & p \geq 0.5 \end{cases} \quad (1)$$

Random sequence p is a numeric in $[0,1]$, $D = |Y*(t) - Y(t)|$ and distance i^{th} whale, b is a constant for denote the figure of the logarithmic spiral, and random number isl in $[-1,1]$, t shows the present iteration, $A = |CY*(t) - Y(t)|$, $B = 2ar - a$, $C = 2r$, a linearly declines from 2 to 0above the sequence of iterations and r denote in $[0,1]$random vector.

In this condition introductory segment is execute the circling machine, while the second impersonates the air pocket net technique. The variable p switches has equivalent likelihood between these two parts. These two conditions utilizing the conceivable area of a hunt operator. The two fundamental stages are investigation and abuse and these are utilizing populace based calculations. They are every two ensured in WOA by adaptively adjusting the parameters an and c in the central estimation.

In every single step of enhancement, search operators illuminate their positions rely upon a haphazardly assigned inquiry the best search specialist obtained up until now. To ensure investigation and intermingling, the better goals is the turn point to advise the situation of another hunt specialists $when |Y| > 1$. In other conditions $(when |Y| < 1)$, the best solution obtained so far acting the role of the pivot point. The WOA pseudo codes are given in Algorithm 1.

Algorithm 1 : Pseudo codes of WOA

Set the whales population $Yi(i = 1,2,3,\ldots,n)$
Set $a, A,$ and C
Compute the fitness of each search agent
$\qquad Y^* = the\ best\ search\ agent$
Procedure $\qquad\qquad\qquad\qquad$ WOA
$(Population, a, A, C, Max\ Iter, ..)$
$\qquad\qquad\qquad t = 1$
$\quad$**while**$t \leq Max$ Iter **do**
$\qquad$**for** each search agent **do**
$\qquad$**if**$|A| \leq 1$**then**
$\qquad\quad$Update the position of the current search
$\qquad\quad$ agent by the equation 2.6
$\qquad\quad$**else if**$|A| \geq 1$**then**
$\qquad\qquad$Take a random search agent Xr and
$\qquad\qquad$Bring up to date the position of the current
$\qquad\qquad$ agent by the equation 2.8
$\qquad$**end if**
$\quad$**end for**
$\quad$Bring up to date $a, A,$ and C
$\quad$Bring up to dateY^*if there is a better solution
$\qquad\qquad t = t + 1$
$\quad$**end while**
$\qquad$**return** Y^*
end procedure

It was confirmed by the discoverers of WOA, which make optimization issues is able to solve in various kinds. It was discussed in the foremost paper, this is due to the high local optima avoidance of this algorithm flexibility and gradient-free mechanism. These inspired our efforts to service WOA for capable task arrangement.

IV. RESULTS AND DISCUSSION

All the computational investigations the presentation of the proposed procedure to use these trial are examined in these segment. Cloudsim device is utilized to run these calculation. The essential stage for these investigation is JAVA. And afterward utilizing PC with Intel Core i5processor, 4 CPU @ 2.9 GHz, 8GB RAM and Windows working framework has 64-piece. At long last, we talked about the incitement result has spent least vitality and least timeframe.

V. MEASURES OF EFFECTIVENESS

In task planning practice of, a few components can be knowing as execution measurements contains as cost and stream time, holding up time, turnaround time, throughput, load adjusting, lateness, and the sky is the limit from there. In beneath upgraded execution are pursues:

Makespan: Specify the time consumed for executing every tasks. This can be deliberate by Eq. (13):

$$Makespan = max_{i \in tasks}\{FT_i\} \quad (13)$$

Where FT_i signifies the finishing task time i.

Energy Consumption: This is the last goal, which is comparative with the entirety of information middles in the cloud.

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The entirety of server farms developments, the vitality factor much develops.

Vitality utilization is considered by duplicating the dispersion framework component by the virtual machine in the vitality spent characterized by Eq. (14):

$$E_c = \frac{1}{VM \times X} \sum_{i=1}^{m} \sum_{j=1}^{n} r_{ij} \times d_{iij} \qquad (14)$$

Where r_{ij} an distribution matrix element characterises, d_{iij} during the execution of a taskthe energy utilized by each and every resource. Virtual machineVM and X represent total of tasks. The equation (15) energy consumption function is represented.

$$F^{min} = E_c \quad (15)$$

Performance Analysis of Proposed MWOA in terms of Makespan

The MWOA introduction result is checked for makespan. The MWOA is compared with GA, ACO, PSO [15] and standard GWO [16] for task planning. The are various from 100-500 errands. In this execution, the undertakings are executed 30 tally of times and afterward figure the normal check. For every one of these emphases, 50 VMs are been estimated. The executed undertakings utilizing normal makespan for MWOA, GA, ACO, PSO and GWO are meant in Table 1. The graphical portrayal of the proposed technique is depicted in Figure 3.

Table 1: Performance Evaluation for Makespan of Proposed Method

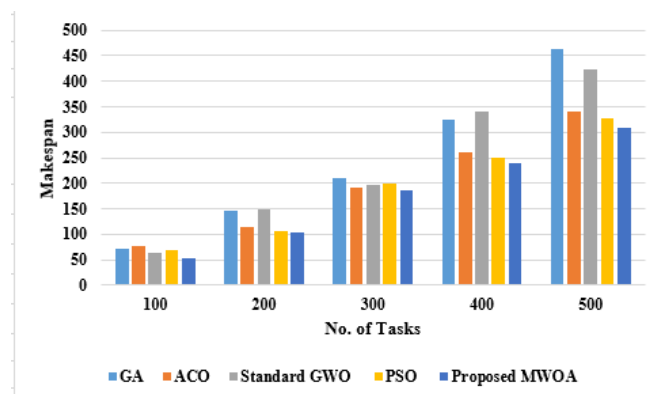| Number of tasks	GA	ACO	Standard GWO	PSO	Proposed MWOA
100	73	78	64	70	52
200	145	115	150	107	105
300	210	192	198	200	185
400	325	260	341	250	240
500	463	340	424	328	310

Figure 3: Performance of Proposed Method in terms of Makespan

The count of cloud tasks is 200, the makespan value for MWOA, GA, ACO, PSO and SGWO are 105, 145, 115, 107 and 150. Similarly total count of tasks is 400, the makespan values for MWOA, PSO and standard GWO are 240, 250 and 341. The makespan values of proposed MWOA, ACO, PSO and SGWO are 310, 340, 328 and 424 when the amount of cloud is 500. Cloud tasks is 100 similarly, the values of makespan are 52, 78, 73 and 70 for MWOA, ACO, GA and PSO. However, the number of cloud tasks is 300,

the makespan values are 185, 200 and 198 for proposed method, PSO and GWO respectively. From these validated results, the makespan values are increased, when increased the count of cloud tasks. The makespan development produced a value by the future MWOA is well in comparison with ACO, GA, standard GWO and PSO.

Performance Analysis of Proposed MWOA in terms of Energy Consumption

Table 2 describes the energy consumption of proposed method against existing techniques namely GA, PSO [15], standard GWO [16] and ACO.

Table 2: Energy consumption of Proposed MWOA

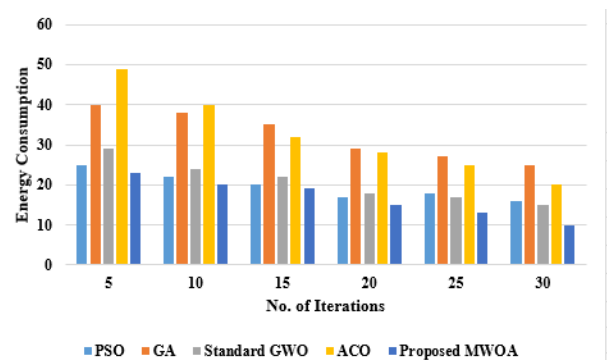| Number of iterations	PSO	GA	Standard GWO	ACO	Proposed MWOA
5	25	40	29	49	23
10	22	38	24	40	20
15	20	35	22	32	19
20	17	29	18	28	15
25	18	27	17	25	13
30	16	25	15	20	10

Figure 4: Energy Consumption of Proposed MWOA

Reduces the energy consumption experiment is result by the proposed MWOA technique, thereby make performance improving. These model 30 iterations are finished for calculating the energy consumption for the period of task execution. The iterations are least (5, 10) the GWO technique makes an energy consumption higher than compare with other two practises. The proposed method achieved closely less than 20% energy consumption for 15th iteration, whereas the GWO achieved 22% energy consumption. The proposed method produces better result while the iteration is increased properly. When compare with others such as ACO, PSO and standard GWO is lower than our technique. The result analysis shows that the proposed technique during task execution takes less energy.

VI.   CONCLUSION

In CC theme, one of the most basic issues is task booking is to be unravelled. It is fundamental for distributing assignments to the right assets and by and large every framework execution is streamlining. Productive errand booking see clients' prerequisites as well as guarantees cloud assets' high use, in order to build up the general execution of the distributed computing condition.

Taking care of the ideal control issues for creating numerical calculation is accounted for in this piece. The strategy is a blend of staggered arranging of the first issue to a limited dimensional streamlining issue and the as of late welcome MWOA. The point of errand booking is to graph assignments to the most reasonable and right assets to be performed with advancement of modified breaking points, for example, the time, value, asset usage, load adjusting and the sky is the limit from there. In this examination, the primary focal point of errand booking is actualized in the cloud to base on execution period and vitality utilization. The outcomes picked up from the reproduction, checks that the proposed MWOA improves task booking execution that time coordinated with the current strategies as PSO, GA, ACO and customary GWO procedures. Later on, this examination work expect to upgrade the work, by coordinating other advancement calculations and methods, heartiness of calculations improving, considering more QoS parameters, for example, the need of undertakings, permitting the movement of assignments between the lines, thinking about the asset usage, dependability, load unevenness and security idea.

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