Grey Wolf Optimized Task Scheduling Algorithm in Cloud Computing

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Abstract. Cost has become the crucial feature for explaining any type of technology efficiently. It is an important aspect for designing any technology. Cloud computing has become the main stage factor of technology by its behavior. Due to its incredible applications and services, figure of choices are growing with time. Therefore, task scheduling algorithms are needed for better execution of any activity. Scheduling is done by appointment of the activities to the machine to run in a better manner. Nowadays users become greedier by changing their demands frequently with enhancement of the technologies provided through the cloud service provider by fruity organization. There are lots of scheduling algorithms based on some priority/nonpriority mechanism to perform a task. To apply filtering in the selection for best scheduling algorithm, a new technique is proposed based on the nature of grey wolf. Comparative study is also considered in this paper with this new optimizing technique. Evaluation is done based on cost factor. Quality of goodness is calculated by the experiments through CloudSim simulator.

Keywords: Task scheduling · Cost · Grey wolf-optimized method · Cloud computing

1 Introduction

Cloud computing is the process which organizes and allocates the resources as a service throughout the network in virtual environment. It introduces the virtualization, grid execution and grouping in the world of technology. This idea changes the classical method of presenting any document into a virtual technology where the users maintain and operate their own connection, data servers and appliances. Cloud computing is a big platform which enables users to get the services through internet on rental basis. It has captured the market with in very short time. The customer base is growing very fast to grasp its services in this cloud computing era.

As guidance, cloud computing cuts down the cost for IT companies by enabling the scalability for usage on requirement with trust factor. They do not need to hire experts to manage technological things because cloud computing provides effective algorithms for the function of organizations. Beginners can learn things easily through cloud computing services. In the current situation, cloud computing works as a wave to blandish impact on technological world. All the organizations use this concept to get

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more attention from users to enlarge the market viewers. Cloud computing also enables career options for the fresher's or experienced to develop their career growth for advanced technology. This process has revealed the directions to explore the countries which are under development.

Scheduling is one of the branch of cloud computing. Task scheduling works for allocation of resources in efficient manner. Many scheduling have been developed for this allocation by applying some priority concept like minimum cost, minimum makespan, security algorithms, load balancing, etc. Cloud computing is also known as a dynamic service provider because it provides scalability and virtualizes resources over the internet. The target to implement new optimized task scheduling is the symbol to accomplish the area of maximum resource utilization and complete the demands of a user [1].

To perform a task scheduling for a particular activity, there are various algorithms, and one such algorithm is nature-based optimized algorithm (NBO). NBO consists of algorithms like termite optimization, ant colony optimization, particle swarm optimization, genetic optimization, honeybees optimization, etc.

NBO algorithm is very popular these days due to its tremendous decision-making capability. It follows the properties created by the nature for human and for animals as well. No one can change these properties. This methodology can be applied in cloud computing and provides the best service for the user in cloud computing environment.

Grey wolf is also an optimized method to calculate the optimized decision. Grey wolf is a part of Canidae family. Grey wolves are always leading the food chain system to get the food. They work in a group always. Number of grey wolves would be 5–12. They have a very rigid and powerful structure as shown in Fig. 1.

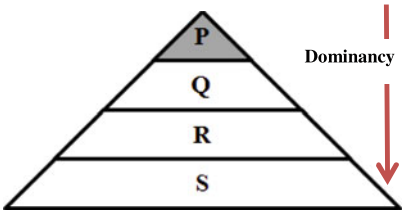

Fig. 1. Grey wolf hierarchy

Ps will lead the desired chain system. These are responsible for making predictions and decisions for hunting, rest space, time to wake, and so on. Decisions are followed by lower level hierarchy. However, sometimes democratic nature has also been caught, in which higher level wolves follow the other wolves. In the group of wolves, the whole system acknowledges Ps by keeping their tails down. These wolves are dominant in nature and have capability to manage the team.

Q is situated on the second level in the hierarchy. These are the followers of Ps and help to make the good decision. In the absence of Ps, Qs work as a decision maker for lower level hierarchy. Qs work as an advisor for Ps as well. Qs broadcast the information, fetching from Ps and passes feedback to the Ps. S is the lowest level in the

designed chain system. S always works in the danger domain. Here is the prediction, that S is not an important individual in the system, but Ss are always ready to face the problem from the target. Observation can be hypothetic here that the whole pack face internal fighting and problems in case of losing Ss. To perform the algorithm perfectly, dominancy must be followed. Rs work as a reference in the absence of P, Q and S. R wolves will follow P and Q, but dominate S. Scouts, sentinels, elders, hunters and caretakers belong to this category. Scouts are able to monitoring the boundary values of the target and informing the system in case of any danger. Sentinels do the protection for the entire system. Elders are the experienced wolves who used to be Ps and Qs. Hunters help the Ps and Qs when moving for hunting prey and makes the food availability for the system. Finally, the caretakers are available for caring the weak, ill and wounded wolves in the system.

Group hunting is another brilliant feature of grey wolves. Muro et al. [2] introduce the working process of grey wolf hunting shows by Fig. 2.

Fig. 2. GWO nature [21]

1. Searching the prey.
2. Encircling the prey and harassing it until it stops their steps.
3. Attack the prey.

Grey Wolf Optimization (GWO) algorithm has been proposed by capturing its nature to get the target.

2 Related Work

The main aim of traditional scheduling algorithms is to reduce the total time cost for processing all tasks. In cloud computing environments, computing services differ from others, and so do the cost of resource usage which is increasing day by day. Therefore, it is vital to take into consideration the usage cost of resources. Along this line, this paper proposes an optimized algorithm by using Particle Swan Optimization (PSO) to resolve the problems associated with task scheduling in cloud computing environments. This is

done by adding a cost-aware mathematical function to identify the actual cost and time of resources usage; this procedure may achieve the goal of minimizing both cost and time, and therefore grasps an optimal solution [3].

In today's scenario users' focal point is quality of service (QoS) while the cloud service providers commit for profit maximization. A productive, service request task scheduling method is in demand to make the user fascinate. Three-tier cloud architecture (consumer, service provider and the resource provider) is proposed for the benefits of user and the service provider by using efficient reallocation scheduling based on utilization ratio leading method. This algorithm fulfills the requisition of both the users and the service providers through this proposed method [4].

Cloud computing is the computing model of different technologies which is registered to provide services on demand. Virtual machine allocation service grants efficient sharing of machines to the located datacenters and these services help to classify and improve the cloud activity. Different services are predefined and addressed and they have their own benefits and limitations. A unique dynamic machine allocation method is proposed in this paper that take machines as per customer demand and assign them into a grouped form to the recognized datacenters. These grouped data use K-Means technique to create a group. First of all, machines are created and then move towards nearest datacenters. This policy improves the processing speed by balancing the load on servers [5].

Cloud computing is a very popular concept for providing the suitable services to the users over the internet on demand. CloudSim is one of the best simulation tool to implement the scheduling concept in cloud computing. Services are to be checked by using this tool to skip all the failures or nuisances before applying on the network. Because of many use of these services, cloud is influenced by the improper utilization of essential resources, and cloud service providers wants to do it in a proper way. An optimal technique particle swarm optimization is implemented in this paper to minimize the makespan and improve resource utilization [6].

Cuckoo's life is used to design optimization technique. Best nest is searched by levy flight to secure the eggs by measuring fitness function. A cuckoo breaks the egg of proprietor bird and keeps the personal eggs into the selected nest. Productivity of proprietor bird is reduced by repeating the production of their own eggs. Then searching process starts for another best place to create the nest by the owner bird. So this searching optimization techniques guide to get the optimum way to perform the task with valid useful outcomes [7].

Cloud computing introduces the clustering model with various technologies that are networked to allocate the services on requirement basis. An optimized dynamic virtual machine (VM) allocation policy is designed in this paper. This research includes VMs as per users demand and provide them in grouping form to the pre-specified datacenters. Clustering is done through K-Means algorithm. First VMs are stabilized and then moved to the nearest located datacenter. It improves the accessibility of servers and utilization of the resources [8].

Cloud computing is a package for various services. Through the service model, provider provides the services to the user. In this paper a model is designed to

recognize the fruity user as well as trusted scheduling. As fruits play an important role in our daily life which keeps ourselves valuable. In the same way, some fruity factors are proposed in the proposed model. Trust ability is refined through these factors which improves the technology [9].

Multiple factors have been included to design the proposed algorithm in this paper. QoS values are fetched from cloud service provider to set the priority. The task with high QoS is set as a high priority and low QoS is set as a low priority. The virtual machine with high MIPS set as a high priority and low MIPS sets as a low priority. QoS contains the factors such as execution time, cost and bandwidth of user. This technique is very useful to get the benefited results in cloud environment [10].

Author designed a novel framework, and it broadcasts a real-time dynamic trust. Third-party service level agreement keeps a dynamic real-time on-demand service establishment component. Service provider is in selection based on the calculated trust. A window-based monitoring is developed in this research; remove the conditions associated to the dynamic real world applications, by reducing the quantity of input set carried throughout the network. The proposed model guides the requested requirements to measure the execution time at which benefits have to be secured and executed. Evaluations have been done by fetching the feedback from the users. By using this monitoring model, exact feedbacks can be retrieved [11].

Author elaborates the performance evaluation of various scheduling algorithms based on some specific parameters. It includes two types of load balancing approaches: mathematical technique and soft computing technique. Experimented analysis shows that algorithms have strength and weaknesses as well. More optimized scheduling can be developed in future to improve the technology [12].

Author proposed a honeybees task scheduling algorithm with reducing cost factor. For enhancement of the result, author evaluated the performance with more number of tasks varying from 20 to 200. In order to gain the reduced cost, performance metrics such as cost and time of basic honeybees and advance honeybees have been calculated as well as compared from traditional scheduling algorithm and found that the proposed algorithm performs better in terms of cost. For future more factors will be considered like trust, fault tolerance and minimum completion time for further enhancement [13].

Author approached a new algorithm which is static-based. It performs well for both heterogeneous and homogeneous processor systems. Its objective is to obtain a good quality of scheduling. Proposed parallel bubble scheduling is a new approach, in which a task is divided into subtasks and performs individually to get the solution. Proposed algorithm performs well with both periodic and non-periodic graph structures with reduced cost factor [14].

Author introduces this algorithm by using two phases. First phase is set the priorities for the valuable tasks; second phase is the selection procedure for the particular task. For the first phase, a priority queue is designed by introducing key values with upper and lower rank. For queue implementation, binary heap is constructed. Initially each task is pointed as a critical task. Then selection phase works with critical path processor. On the other hand, assignment of the task enters in the processing, which reduces the earliest finish time for a particular task [15].

Author developed a tabu search algorithm. It is a technique for searching best quality neighbor. It finds the global optimum solution. It keeps the record of already searched solution in order to avoid the repetition for searching another node. It checks for all the possible outcomes in all direction and then moves towards the best direction by using tabu search optimization algorithm [16].

Author represents task scheduling in multiprocessor system. By creating a queue, a novel scheduling approach has been designed, which uses a searching algorithm called as breadth-first search. The proposed algorithm uses two queues. First is Ready Task Queue (RTQ) and second is Not Ready Task Queue (NRTQ). By applying precedence, these queues are computed. Priority has been designed by using RTQ. The proposed algorithm outperforms with the experimented results in the technological world [17].

Author introduces the technology to do the analysis of large document file. Due to heavy amount of data, applications are increasing day by day. The proposed technique uses clustering method. By using this method, many areas have accomplished such as optimal searching, no duplicacy, referenced documents and retrieval of useful data. MapReduce techniques are doing well for the innovation in latest research [18].

Author improves the visual quality for the image by using ant colony optimization (ACO). An image is the most important key point to express any type of work/data. In many cases, images got blurred due to the processing of complex data. To improve the quality of the image, author rectifies the non-linear anisotropic diffusion filter by adding the fruitful features of ACO technique [19].

Author explains various optimized task scheduling algorithms in cloud computing environment and calculates the allocation cost factor for quality of service optimized task scheduling algorithm and shows the improved results with comparison of traditional task scheduling algorithms [20].

3 Proposed Algorithm

There are many optimized algorithm in cloud computing to fulfill user requirements. All optimization techniques are performed very well in technology. Here a bio-inspired algorithm GWO is used to optimize the task scheduling algorithm to get the user more benefited. To fulfill the optimization, searching is done based on random steps initially. To search for prey, all grey wolves will be scattered in the region randomly and ready to search in a certain position called as a search space (Sp).

By calculating the fitness value for each wolf, technique will move on to get the hunt. Fitness of grey wolves introduced randomly in a search space is calculated by using various traditional benchmark formulas and are saved with their respective fitness values.

After getting the prey by the initial wolf, all other wolves will come and participate in that and make the group together and encircle the prey.

To attack the prey, Ps guide the lower level wolf towards hunting. When the moving steps are close to stop of the prey, Ps do disclose the message to attack the prey.

Algorithm: GWO optimization
Input: Set of agent i, space
Output: optimized decision

Initialization : space Sp randomly
1.init(i_1,Sp)
2. init (i_2,Sp)
3. init (i_3,Sp)
4. //i_1, i_2 and i_3 are belong to S category
(where S represent the Lowest level in hierarchy)
5. These three agent will search for prey to hunt and
6. Pass this information to upper level of Gery wolf, then
7. P's will guide to lower level grey for attacking towards prey.

3.1 Simulation Result

CloudSim3.0 simulator is used to simulate this proposed task scheduling algorithm. To show the effective performance with cost parameter, an open source is considered with two host node to implement the scheduling method with hundred activities on 30 virtual machines. It can be dynamically modified with respect to the number of tasks for desired simulation. This simulation will show the results between traditional and optimized proposed method with cost factor.

To estimate the effective performance of scheduling methods, datacenters, virtual machines and many cloudlets based on user's requirement is created in the simulator.

Figure 3 illustrates the comparison between GWO and FCFS task scheduling algorithm with parameter allocation cost against hundred cloudlets. According to resultant graph, variation takes place for cost factor. At some point cost is high, but at some points cost is very less. Overall performance is stated that cost is reduced in optimized technique. Thus optimized technique improves the performance of the system.

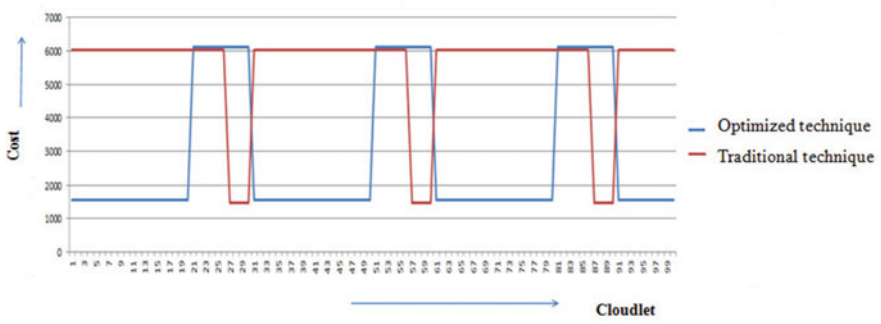

Fig. 3. Comparison between GWO (optimized) and FCFS (traditional)

4 Conclusion and Future Work

The traditional way of task scheduling in cloud computing to execute or schedule the task is very costly. To get the optimized results, optimized algorithm must be proposed. GWO is a nature-based algorithm that is used to get the optimum results. Cost parameter is considered in this paper. At some point, optimization is lacking with the results. So for more accuracy, many algorithms will be introduced in cloud computing to enhance the trust factor in future.

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