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Ant Colony Optimization for Efficient Resource Allocation in Cloud Computing

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Abstract—Resource scheduling and energy consumption is an important issue of Cloud Computing. The intention of optimization for scheduling resources is an important issue to be considered in scheduling of different resources among heterogeneous users. The resources are placed in a distributed location in cloud and the major task is to distribute the resources effectively such that the processing time and energy is reduced. In this paper, Ant Colony optimization technique is proposed to optimize the resources in an efficient manner. ACO is used to choose one among the different alternative paths to determine the processing order of each resource. The search space is reduced to provide a better solution. Travelling Salesman Problem(TSP) is the application that is used here to find the shortest path to the destination. This reduces the delay in allocating resources to the user by providing a global search technique. The energy conservation which is the main objective of Green Computing, can also be achieved using this technique.

Keywords: *Green Computing, Ant Colony Optimization, Travelling Salesman Problem.*

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I INTRODUCTION

Green computing is the term used to specify the efficient use of resources in computing. This concept generally relates to the use of computing resources in coexistence with minimizing environmental impact and maximizing economic sensibility [1]. Green computing is the concept of reducing the use of environmentally hazardous materials like CFCs, promotes the use of recyclable materials, the aim of minimizing the non-biodegradable components, and encouraging use of endurable resources.

Green computing is very beneficial to the environment. The energy usage is reduced using few green techniques which translates the lower carbon dioxide emissions, stemming of a reduction in the fossil fuel used in power plants and transportation. The less usage of energy for producing, using and disposing the resources results in conservation of energy. The more you save energy, the less you spend on resources. The advantages of green technology are implemented on both large and small scales.

The Advantages of this technology are-

- The energy consumption of the computing resources is reduced during peak time
- Saving of energy during idle time
- Regular usage eco-friendly sources of energy
- Harmful effects of computing resources are taken care.
- Wastage of computing resources is reduced

The main objective of green computing is to increase the equipment's lifetime.

Cloud computing is defined as a computing paradigm that aims to provide reliable, flexible and QoS (Quality of Service) guaranteed in providing services to the cloud users in distributed environment. Distributed processing, parallel processing and grid computing together is termed as cloud computing. The basic principle of cloud computing is that the user data is stored in data centre on internet rather being stored locally. An Application Programming Interface(API) is provided by cloud provider so that the users can access the stored data at any time through any terminal equipment connected to the internet.

The services provided by service providers can be categorized as- Infrastructure as a Service (IaaS), Platform as a Service (PaaS) or Software as a Service (SaaS). There are innumerable advantages of cloud computing, the most important ones are cost productive, availability of resources and remote accessibility.

In cloud computing, Resource Allocation (RA) is the process of allocating available resources to the specific cloud applications over the internet. If RA is not managed properly, it may result in lack of services. Resource provisioning overcome the problem by allowing the service providers to allot the resources for each single module.

The scheduling tasks must change for specific tasks and environment. Ant Colony Optimization (ACO) is one of the dynamic scheduling algorithms used in Cloud based scheduling approaches [2]. ACO as of the name it uses mechanism of ants to allocate the resources. In this paper, the

resource allocation is done in a dynamic manner using ACO algorithm.

II EXISTING SYSTEM

In particle swarm optimization (PSO) algorithm it is easy to fall into local optimum in high-dimensional search space and has a low combining rate in the iterative process. Several investigations have been done to improve PSO algorithm by the developers. The particle optimization is based on the different topology structure. Although it can avoid algorithm falling into local optimum to some extent, however, different problems need to be solved on the different topology structure. And it is difficult to predict the best topology before the process in advance. So, the adaptability of the algorithm is not ideal.

III PROPOSED SYSTEM

An Ant Colony Optimization (ACO) based model is used to provide resources among the tasks optimally. In-order to carry out the computation, initialize some random sequences to satisfy the tasks and determine the task resource requirements in a matrix. During each process identify the optimal values and update the score values.

IV ANT COLONY OPTIMIZATION

Ant Colony Optimization principles is related to the natural behavior of ants. The daily lifestyle of ants is to search for food near to their nests. While ant travel in search of food it deposits, a chemical substance called pheromone. This is done with two intentions. That is, it allows other ants to find their way back to home. [4] And on the other hand, it allows other ants to know the way its predecessor has taken to reach the food, so that the others can follow the path. The path with the higher concentration of pheromone is considered as the shortest path resulting in a larger number of travels through the path therefore with much more ants depositing pheromone on it. This is how the communication between ants happen to find the shortest path to the destination. Once the pheromone concentration decreases, the ant take more time to travel from source to destination.

Ant Colony Algorithm is a probabilistic technique used to find optimal paths for resource allocation. The ants follow the pheromone trails left by their predecessors to find shortest path. This pheromone trails fades away or decays after some interval of time. Hence each ant will have different probabilistic choice. The pheromone trail with high concentration will be considered as the shortest path and followed by other ants.

Ant Colony System algorithm is used for optimizing a cost function. The probabilistic way of construction makes use of both pheromone and problem-specific heuristic information to construct a solution. Each component can only be selected if it has not been used, and for those components that can be selected from given set of current component, the probability for selection is defined as:

$$P_{i,j} \leftarrow \frac{\tau_{i,j}^{\alpha} \times \eta_{i,j}^{\beta}}{\sum_{k=1}^{c} \tau_{i,k}^{\alpha} \times \eta_{i,k}^{\beta}}$$

Where $\Pi_{i,j}$ is the maximizing contribution to the overall score of selecting the component, β is the heuristic coefficient, $\tau_{i,j}$ is the pheromone value for the component, α is the history coefficient, c and is the set of usable components. A greediness factor (q^0) is used to influence when to use the above probabilistic component selection and when to greedily select the best possible component.

A local pheromone update is performed for each solution that is constructed to prevent following solutions to use the same components in the same order, as follows:

$$\tau_{i,j} \leftarrow (1-\sigma) \times \tau_{i,j} + \sigma \times \tau_{i,j}^{0}$$

Where $\tau_{i,j}$ represents the pheromone for the component, σ is the local pheromone factor, and $\tau^{0}_{i,j}$ is the initial pheromone value.

At the end of each iteration, the pheromone is updated and decayed using the best candidate solution found thus far as follows:

$$\tau_{i,j} \leftarrow (1-\rho) \times \tau_{i,j} + \rho \times \Delta\tau i,j$$

Where $\tau_{i,j}$ represents the pheromone for the component, ρ is the decay factor, and $\Delta\ \tau_{i,j}$ is the maximizing solution cost for the best solution found so far if the component i,j is used in the globally best known solution, otherwise it is 0.

A. Resource Allocation process

The resources much be allocated to the tasks in such a way that the total execution time of the tasks must be reduced.

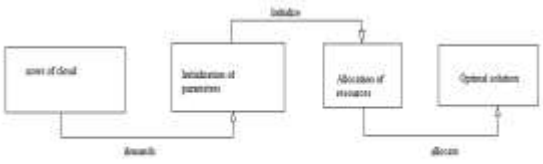

Figure 1: Resource allocation model

The allocation of resources is done in three steps as shown in figure 1:

- Understanding user demands
- Initialization of parameters
- Allocation of resources

The tasks and resources of all the processes are placed in heterogeneous locations. In cloud system, the allocation of resources is done dynamically on demand by the applications

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[2]. Many different scheduling approaches are used for providing and scheduling resources. The resources much be allocated to the tasks in such a way that the total execution time and cost of the tasks are reduced by assigning time slots for each task.

B. Resource allocation using ACO

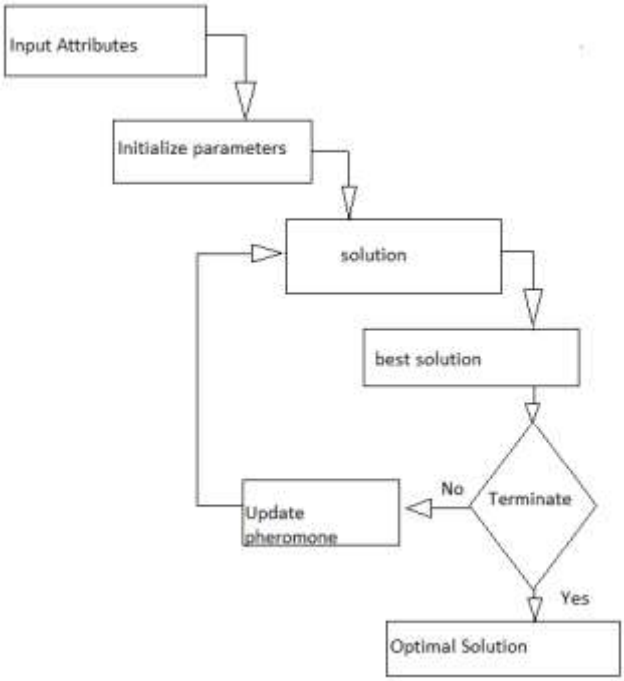

Figure 2: ACO based resource allocation

The resource allocation process using ACO is as follows.

- The input attributes about the number of processes, tasks and resources are noted down.
- The ants used for the process and the pheromone trails used by the ants are recorded. Two pheromone trails are used in this algorithm. The first one is used for choosing the shortest path i.e. pheromone trail intensity and the other one represents the desirability of choosing the desired resource.
- In this construction stage the ant allocates the resources to task based on the probabilistic choice rule which is represented in terms of pheromone and heuristic information [5].
- The probabilistic choice rule is used. if there is any conflict in the process of scheduling
- The current best solution (ibest) and the global best solution (gbest) are recorded.
- After a specified number of iterations, check whether best solution is achieved or not. In case if gbest achieves poor solution, then the solution is reconstructed to get an optimal solution.

This way the ACO finds the optimal solution and allocate resources effectively.

C. Travelling Salesman Problem

Traveling Salesman Problem's Heuristic is the method which has been used along with ACO algorithm. In this problem, a salesman should visit n cities, in which each city must be visited only once, the starting point is called as base city after visiting all the cities it returns to the base city. The transportation cost among the cities is considered. The problem is to find the path which has the minimum cost while visiting all the cities [3].

The TSP plays an important role in Ant Colony Optimization which is also called as ant systems. The reasons for choosing TSP are:

- ACO is easy to apply to this problem.
- It is based on N P-hard optimization problem.
- It is considered as a standard test-bed for new algorithmic ideas and a good performance on the TSP is often taken as a proof of their purpose.
- It is easy to understand, so that the algorithm behaviour is not concealed by too many methods.

V RESULTS AND DISSCUSION

The objective of reducing the energy consumption is achieved by increasing the number of ants and iterations.

The performance comparison by increasing the number of iterations are represented in the Figure 3 and 4. Results have shown that when the number of iteration is increased the processing time is reduced.

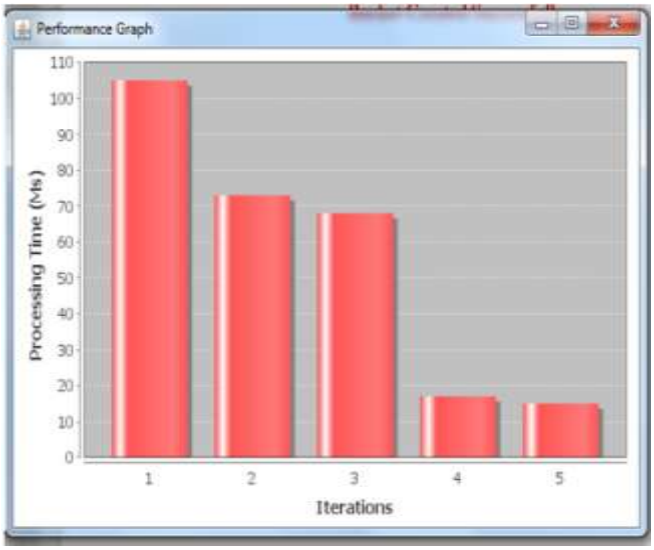

Figure 3: Result for 5 iterations

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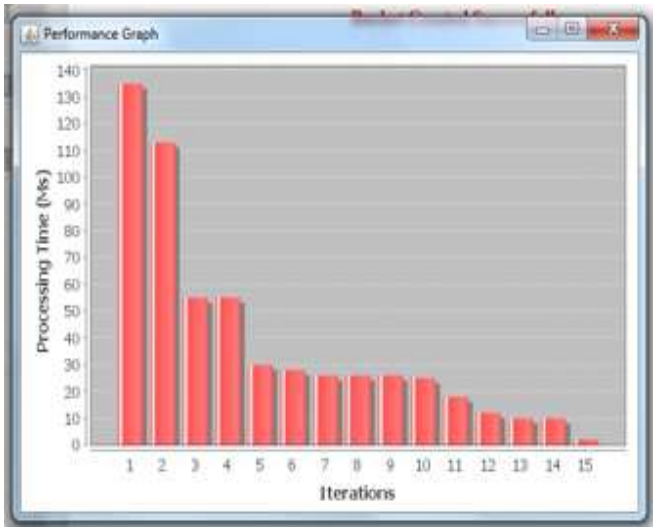

Figure 4: Result for 15 iterations

CONCLUSION

The algorithm implemented in this paper, take care of effective allocation of resources to the tasks. Energy conservation is the main moto of this work, the ACO algorithm reduces the amount of energy used by each resource and hence the performance of the system is increased. Effective time utilization is also done using this algorithm. The results have shown minimization in execution time.

REFERENCES

[1] N.C.Brintha, J.T.Winowlin Jappes, and Shajulin Benedict, "A Modified Ant Colony Based Optimization for Managing Cloud Resources in Manufacturing Sector" 2016 2nd International Conference on Green High Performance Computing (ICGHPC)

[2] Xianmin Wie and Hong Liu, "A Cloud Manufacturing Resource Allocation Model Based on Ant Colony Optimization Algorithm" International Journal of Grid Distribution Computing vol.8, No. 1 (2015).

[3] Amit Agarwal, Saloni Jain., "Efficient Optimal Algorithm of Task Scheduling in Cloud Computing Environment", International Journal ofComputer Trends and Technology (IJCTT) ,vol. 9, no. 7, pp.344–349, Mar 2014.

[4] J.F. Yu, Y. Li, H.S. YuandQ. Shen., "Resources optimization deployment in collaborative manufacturing project based on adaptive ant colony algorithm", Computer Integrated Manufacturing Systems, vol. 14, no. 3, 2008.

[5] Gao K., Wang Q., and Xi L., "Reduct Algorithm Based Execution Times Prediction in Knowledge Discovery Cloud Computing Environment", The International Arab Journal of Information Technology, vol. 11, no. 3, pp. 268-275, 2014.

[6] Li BH, Zhang L, Wang SL, Tao F, Cao JW, Jiang XD., "Cloud manufacturing: a new service-oriented networked manufacturing model", Computer Integrated Manufacturing Systems, vol.16(1), pp.1–7, 2010.

[7] Zhang L, Guo H, Tao F, Luo YL, Si N., "Flexible management of resource service composition in cloud manufacturing", International conference on industrial engineering & engineering management, pp. 2278–2282, 2010.

[8] Kumar.R, Tiwari.M.K, Shankar.R., "Scheduling of Flexible Manufacturing Systems: An Ant Colony Optimization approach", Proc. Instn Mech. Engrs, vol. 217, pp. 1443-1453, 2003.