Efficient Task Scheduling Over Cloud Computing with An Improved Firefly Algorithm

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***Abstract* - With the increase in the number of systems in the world it becomes necessary to provide those systems to process faster jobs with the same configuration. To achieve such complexities, computation should be performed somewhere on other system with high configuration, for that technology is shifting toward cloud. Cloud is the internet work of high configuration machines where all such computation is performed. But with the increase number of users it become necessary to provide them the result in real time, for that scheduling is must over the cloud. Many scheduling algorithms had been proposed and is being proposed in this area to achieve better and better result. Initially it was started with FCFS, SJF later on scheduler is shifted toward the meta-heuristic algorithm like ACO. Here we have proposed Adaptive or Improved firefly algorithm and compared its result with ACO.**

***Keywords* - cloud computing, job scheduling, cloud sim**

I. INTRODUCTION

Cloud Computing is a model for conveying and hosting services on the internet. This model played important role when anybody started any organization from low level and add more resources according to the need. It is new computing technology that aim to provides quality of service reliable for user [1]. cloud computing organization deals with large scale, large amount of data, the demand of computing power, need to increase system investment. It is one of efficient technology that is popular nowadays in IT field. Many change in the computing industry due to the cloud computing. It is an extension of Distributed computing, Grid computing and Parallel computing. It defined by the US National institute of standards and Technology states that cloud computing is a model for on demand network access to shared computing resource [1]. It is paradigm for distributed computing that delivers infrastructure, software as services and platform. It helps user applications provider of dynamic services using large scalable, secure, quick, data storage and virtualized resources over internet. Economically, the main goal of cloud computing is that customers only use when need, and only pay for actually use.

These resources are available in cloud every time and to be accessed from the cloud any time, any location via the internet [2]. It is supposed to manage the execution of tasks, operations, virtual servers, virtual infrastructure as well as the back end hardware and software resources of cloud environment. To gain the maximum benefits from cloud computing, developers must design mechanisms that optimize the use architectural and deployment [3]. The hardware and software provided support to virtualization. virtualizes many factors such as operating system, software and hardware manage them in the cloud platform, no environment to do anything without physical platform. Virtual Machine play important role in cloud computing because whole work of cloud related to the virtual machine. Its advantages only get when it is connecting to the internet that's why user can use the powerfully computing services. It provides services according to user requirement. virtualization provides technical support for cloud computing applications and virtualization technology. In the past few years, the cloud computing research and development group such as IBM, Google all the well-known IT companies launched a cloud computing.

It is shared large number of services and resources provides for multiple users. cloud model has three delivery model and four deployment models because of its operational and economic benefits [4]. It shared resource and depend on the economics of scale, same as power network. It changed the client server. It provides many facilities not only the end-user but also the enterprise and organizations. It sorts architecture in particular public, private and hybrid so on. Cloud computing capacity planning dynamic upload and download the resources accordingly. It achieves the minimum waiting time, maximum throughput and good performance

II. RELATED WORK

Akhil Goyal et al (2015) This paper discusses load balancing using a nature inspired algorithm known as Particle Swarm Optimization (PSO) algorithm. A different nature inspired algorithm known as Firefly Algorithm (FA). To reduce this wastage of energy there must be some appropriate way for resource provisioning. Load Balancing is one of the important processes which distribute the working load among the participating nodes [5].

Eakta kumari et al (2015) This paper define the job scheduling techniques. task scheduling is used to allocate certain task to particular time in particle resources. Task scheduling is challenging task in cloud computing because at a one-time many tasks are come at a same time. scheduling lead to high throughput and response time [6]

Pardeep Naik Et Al (2015)-In this paper discuss the various job scheduling algorithms. The paper also includes proposed system with improved quality of service. A proposed system is based on bipartite matching. In which resource are allocated on different cloud overload condition and under-load is proposed system. The users are requested for jobs and executed, based on certain parameter that are already define for user request, it includes the storage space required for each job. Cloud environment include virtual machine to perform effective allocation, it is done by the maximum matching using bipartite graph [7].

Saurabh Bilgaiyan et al (2015) Job scheduling is one of the important factor that effect the cloud performance and resource utilization. This paper discusses some best swarm based scheduling techniques. These techniques compare on the bases of parameter, application and advantages. Every technique has its own parameters and objective, some based on minimize total execution time. other are based on maximization throughput [8].

Yang Zheng et al (2015) In this paper discuss the ACO-Testing scheduling. It executes testing tasks in cloud testing, the minimum execution time and load balance of virtual machine should both be taken into account. ACO-TD dependencies between testing task and proposed. It not only possesses advantages of ACO, but also makes up shortcomings of ACO. It is implemented on cloud sim platform [9]

Wu Mingxin (2015) In this paper define the key technology and corresponding characteristics are reviewed the aspects of cloud computing. Paper define the how task are scheduled efficiently has become an important problem to be solved in the field of cloud computing. The presents a dual adaptive task scheduling algorithm based on genetic algorithm. This algorithm defines the completion time of task. It is kind of effective scheduling algorithm. [10].

A.paulin Florence et al (2014) In this paper discuss the load balancing based scheduling is developed for the proposed approach .The approach is inspired from the firefly algorithm. It is divided the load into the different nodes [11].

Fazel Mohammadi et al (2014) In this paper discuss the different types of job scheduling algorithm like PSO, PSJC, ACO in cloud computing environment. These all are compare with different types of parameter that is shown on table, based on the comparison summarizes the algorithm and some method improve the performance. Job scheduling algorithm is NP-Hard and NP-Complete problem which places an important role in cloud computing. [3]

Ms. D. Thilagavathi et al (2014) In this paper, proposed two algorithms like Firefly Algorithm and Intelligent Water Drop Algorithm which outperforms the results of conventional algorithms and also some swarm intelligence algorithms like Ant Colony Optimization, Particle Swarm Optimization compar0atively. This paper presents strategies for scheduling jobs in HPC environment using IWD algorithm and firefly algorithm which is able to find optimal solutions. The IWD and FA algorithm demonstrates that the nature is an excellent guide for designing and inventing new nature-inspired optimization algorithms. [12]

N. Susilaet al (2014) In this paper proposed the firefly load balancing algorithm for the cloud, in a partition cloud environment to balance the load across the different partitions. The proposed system aims to minimize the node load and analyzing through various parameters. A balance factors is calculated the load and fuzzy logic is applied to resolve the time uncertainties following the starting stage of the load balancing. By applying this logic, it is observed that, a better performance is achieved [13].

III. METHODOLOGY

The thesis proposes an improved firefly algorithm for solving the job scheduling problem in cloud computing. The approach has two aspects. The First approach deals with the development of the cloud framework for job scheduling while the second with the development of firefly algorithm which would be applied on the cloud so as to improve the job scheduling scheme. The number of resources should be timely processed “used by each cloud user based” on the time occupied and network access charges. The Job scheduling algorithm will not only focus on whether the total time required to complete the task is minimized, but also on the time cost for finishing the subtasks. This will prevent the misallocation of time and resources in the multiple tasks performed by the cloud users.

The following assumptions are made while carrying out this work.

- The larger tasks are separated into a certain number of subtasks, to make the execution time of each subtask of little difference as far as possible.
- The quantity of resources allocated meets the demands of subtasks
- Reasonably define the time during which the sub-tasks occupy the resources so that the time spent on each subtask is of little difference.
- Calculate Value of the ACO and Improved Firefly. This value is calculated based on jobs parameters. First of all, discuss the job parameters. Job parameter include the Number of jobs, Number of Processing Element, Length of jobs /Total job size (MB), File size which is to be Processed, Output size /size of each job. Formula for calculate length of jobs = Number of job * File size of job

IV. RESULTS

Calculate Value of the ACO and Adaptive Firefly. This value is calculated based on jobs parameters. First of all, discuss the job parameters. Job parameter include the Number of jobs, Number of Processing Element, Length of jobs /Total job size (MB), File size which is to be Processed, Output size /size of each job.

Formula for calculate length of jobs = Number of job * File size of job

Table .1 Number of job fixed 100, No. of processing Element's Change's or variable

No. of job Fixed	**No. of Processing Element**	**ACO (Total Execution Time (in ms))**	**Improved Firefly (Total Execution Time (in ms))**
100	1	3800.01	1800.06
100	2	7466.99	3600.06
100	3	10800.02	6600.05
100	4	16000.03	8266.72

Table 2 Number of Processing Element is Fixed at 1, 2, No. of jobs variable

No. of job	**No. of Processing Element (Fixed)**	**ACO Algorithm (Total Execution Time (in ms))**	**Improved Firefly Algorithm (Total Execution Time (in ms))**
100	**1**	3800.01	1800.06
200	**1**	7266.59	3666.72
300	**1**	10266.51	5666.66
400	**1**	13066.45	6999.93
100	**2**	7466.99	3600.06
200	**2**	13066.61	7600.02
300	**2**	22399.83	11199.97
400	**2**	27066.43	13599.99

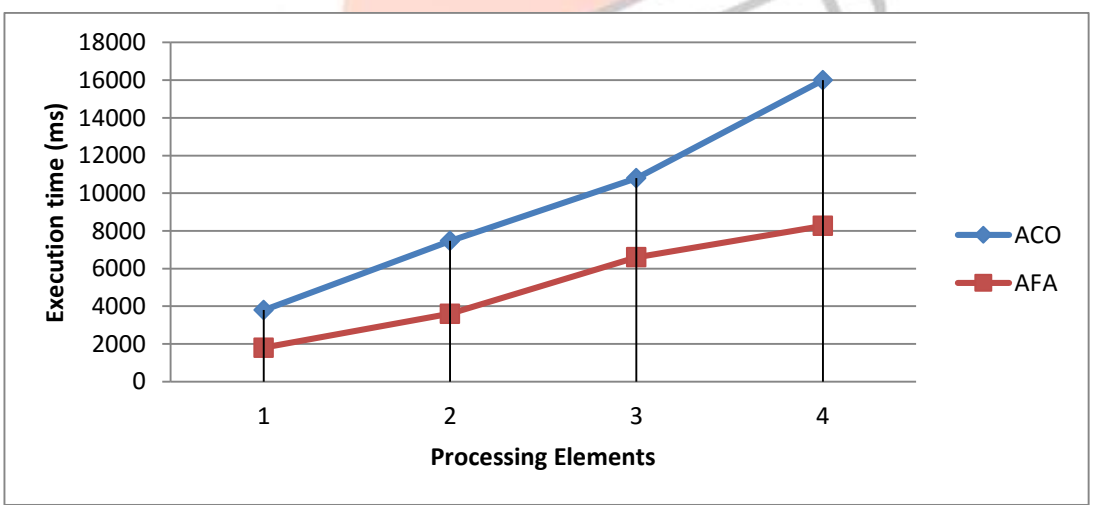

Figure 1: ACO v/s AFA keeping no. of jobs fixed at 100 and varying no. of Processing Elements

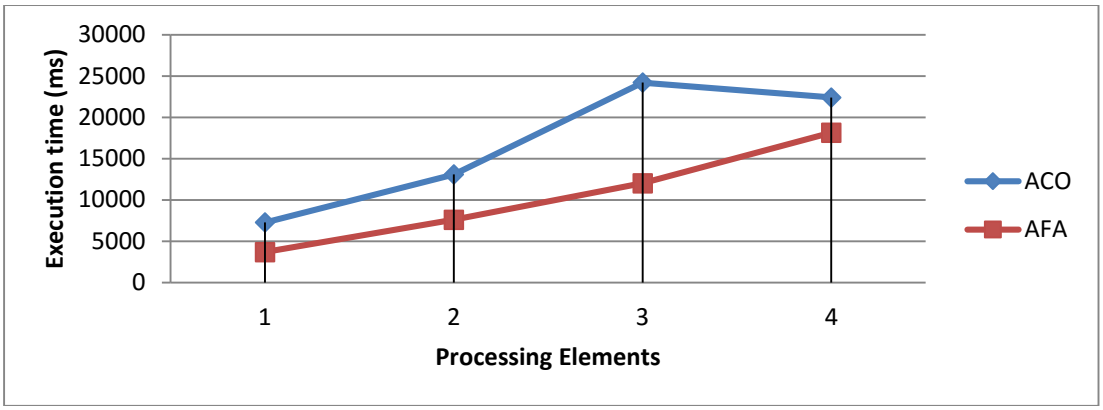

Figure 2: ACO v/s AFA keeping no. of jobs fixed at 200 and varying no. of Processing Elements

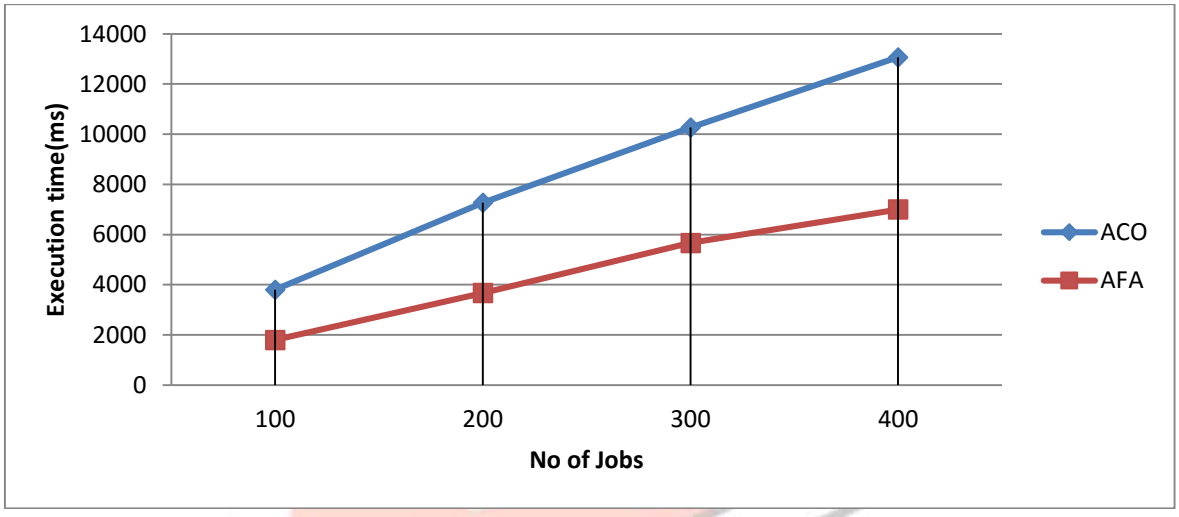

Figure 3: ACO v/s AFA keeping no. of processing elements fixed at 1 and varying no. of jobs

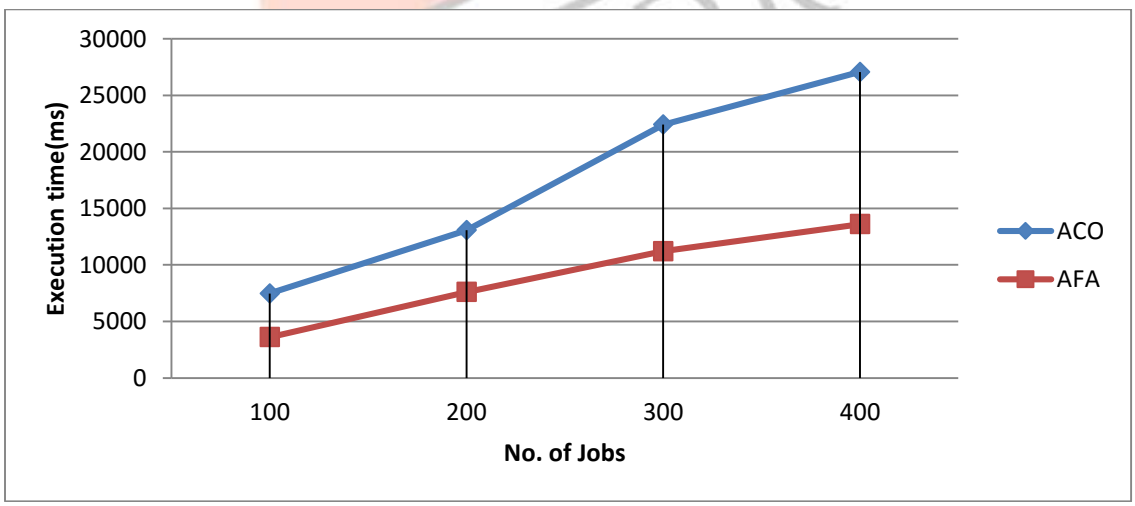

Figure 4: ACO v/s AFA keeping no. of processing elements fixed at 2 and varying no. of jobs

From above shown figure it has been cleared that the performance of Adaptive firefly over the Ant colony optimization is better in all aspect. In the mention graph number of job has been varied keeping the number of processing element fixed required by the jobs, and also keeping number of Job/cloudlets fixed and varying the number of processing elements.

V. CONCLUSION AND FUTURE SCOPE

Scheduling is one of the most important tasks in the cloud computing environment. In this thesis we have implemented Ant Colony Optimization and Adaptive firefly and tested the results of the algorithm on cloudsim-3.0 by varying the configuration of virtual machines. After running the algorithm for different sets of jobs given to cloudsim-3.0 we are able to conclude that the results of Adaptive firefly are quite better as ACO. As the total time taken by the Adaptive firefly is less as compared to the earlier one, hence the number of jobs send over the cloud will execute faster as compared to other. So, by adding the new parameter $\alpha$to the algorithm of firefly, taking extra virtual machines configuration and cloudlets/jobs status parameters to modify the equation of $\alpha, \beta, \& \gamma$ and hence Intensity of the firefly to make it Adaptive firefly, we achieved the better results.
For the future references this algorithm can be applied over the different types of the job scheduling over the cloud to make the services execute faster over the cloud. We have applied and tested the proposed algorithm on one of the types of job scheduling over cloud. The proposed algorithm can also be tested for the others too by using different simulators like Workflows-sim.

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