Adaptive job scheduling on computational grid for resource allocation and job completion Based on Feature Selection

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ABSTRACT
Resource allocation is a major issue in computional grid computing. Due to limitation of resource and increasing rate of job faced a problem of maximum number of job failure. The maximum number of job failure decreases the perfromance of computional grid. The process of resouce and job allocation in computional grid have no standard method. The process of job allocation adapt first come first serivce. For the improvement of rsource allocation along with job used multi-cretria of ant colony optimization technique. The multi-cretria ant colony optimization technique failed in the case of large number of jobs in limited number of resource. For the improvement of job selection in multi-cretria ant colony optimization used TLBO selection process. The TLBO is new meta-heuristic function. In TLBO the population of new jobs like a student and selected job like a teacher for the process of ant colony optimzation technique. The modified process selection algorithm in ant colony optimization pridict better job for the limited resource allocation process. The modified ACO-TLBO resource allocation along with jobs simulate in MATLAB software. MATLAB is well know simulation software for the algorithm analysis. For the experimental process used different size of grid. Our experimental result shows that better job completion ratio instead of MC-ACO.

Keywords: - Resource allocation, TLBO, MC-ACO.

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INTRODUCTION

Grid systems and applications aim to integrating, virtualization, and managing resources and services within distributed, heterogeneous, dynamic virtual organizations. Therefore, resource allocation becomes an important issue with increasing attention. In grid environments, the allocation problem can be defined as the provision of allocation, configuration, and monitoring for the resource ensemble required by a single application. In conventional grid systems, co-allocation service mainly concentrates on system-oriented metrics, such as uniform programming interface, resource availability, load-balance and throughput. As more and more grid system began to provide service for public society, resource price become a critical issue when users want to execute their applications on given grid systems. In other words “A computational grid can be defined as distributed infrastructure that provides convenient and inexpensive access to high-end computational resources. The resources are collection of computers, online devices, and data sets that are connected network interface which provide users with suitable access to the set of resources for providing a set of services”. The grid applications often involve selection and sharing of large amounts of data and secure resources across different organizational domain. The common issue of grid system is the resource allocation for jobs and providing (Quality of Service) QoS to the users at the same. The job allocation mechanism aims to maximizing their utilization and minimizing the average job execution time. The job allocation algorithm is described as static and dynamic nature. In static algorithm, the job allocation is done on the basis of policy imposed in advance and remains constant during runtime i.e. FCFS, Backfill and SJF etc. Because of constant change in grid system, such algorithm is not applicable. This type of algorithm is not suitable for such dynamic environment. Grid system is a dynamic environment with constant changes worst scheduling affects the computing and utilization of resources. The In dynamic algorithm, the decisions are taken at runtime and results in better performance in term of efficiency. In grid system, there are two sides; first are the set of heterogeneous resources and the group of grid users looking for the execution of job to be done. So the aim of scheduling is to manage both sides with the maximum efficiency. Grid scheduling is essential to provide consistent and coordinated use of heterogeneous Grid. Because of the dynamic nature of the grid, scheduling is significantly complex due to the difference in performance goals by various grid applications (users) and grid resources. Most grid systems use grid scheduler responsible for resource allocation and available

resources, by selecting the most suitable resources that provide user's request, and allocating the task onto selected resources. The rest of paper is organized as follows. In Section II state the problem. The Section III Related work IV discusses proposed methodology. In section V discuss performance evaluation and result analysis followed by a conclusion in Section VI.

II PROBLEM STATEMENT

Grid computing is an environment with constant changes Poor resource scheduling affects the computing and utilization of resources in a heterogeneous environment. The crucial factor in grid scheduling is that, the inability to control all the jobs completely. The dynamic nature of resources and the difference between the expected time and the actual time of execution in algorithm are the other challenges faced. The main goal of the grid scheduling is assigning the jobs to the available resources efficiently. The suitable match should be assigned from the list of resources available and the list of available jobs. In order to solve the scheduling problem, many algorithms like ACO, Genetic algorithm and simulated annealing have been approached. An adaptive task scheduling algorithm MCACO has been currently used. It is an extension to ACO algorithm .ACO algorithms have been applied to many real world application problems. The process of job and resource in grid scheduling react on the time of job selection process. If the selection of job process is optimal the execution of job is better. if the selection of job is non optimal the process of job failure is increases. Some problem related to MCACO discuss here.

-The selection of job process in MCACO on normal process and job list is maximum.
-The constantly updated value of pheromone generates large difference value of job.
-Make span time of MCACO is high.
-Local and global matrix update process is call in each job execution time.
-Computational time is high due to long job pull.

III RELATED WORK

In this section discuss the related work of software quality estimation using data mining technique. Some technique discuss here.

[1] In this title author explained that MCACO obtains the key ideas from ant colony algorithm for scheduling efficiently and considers the load in grid environment. The purpose of the algorithm is to balance the load and to reduce the make-span. An algorithm for scheduling of jobs in grid environments was investigated as an optimization problem. The proposed algorithm developed a framework for scheduling using the current status of resources and a cost model for minimizing the total tardiness time of a job. Ant Colony Optimization algorithm was used in the algorithm to make an efficient resource assignment for each job being processed. A scheduling decision was found for every resource to allocate to a task thereby minimizing delay of execution beyond the expected time when the job was scheduled in the system.

[2] In this title author explained a new method for computational grid as load balancing query processing in metric-space similarity search as Metric-space similarity search has been proven suitable for searching large collections of complex objects such as images. A number of distributed index data structures and respective parallel query processing algorithms have been proposed for clusters of distributed memory processors. Previous work has shown that best performance is achieved when using global indexing as opposed to local indexing.

[3] In this paper author explained a new method of prediction of service control as prediction service controls the overall prediction procedure, and evaluation services are used for evaluating model fitness in parallel. The number of evaluation services used for fitness evaluation is equal to the number of particles in the PH-PSO algorithm. All the tests are implemented through dynamic collaboration of system services. High accuracy and efficiency is the primary design goal of the prediction subsystem.

[4] In this work author presents advance reservation is mainly concentrated based on the job given by the client is placed in the placement Queue based on first come first order. Index server is a server which contains all available resources. Index server is maintained separately. The jobs placed in the placement Queue is given to the scheduler for advance reservation. If the resource needed for the job is not available in index server then the job is placed in the tail of the placement Queue. For advance reservation, first the jobs are placed in the shortest job first queue based on shortest job order. After placing the job queue, the jobs are scanned from fir queue and check whether the resources needed for the job is in the same cluster or not.

[5] In this work author presents discuss about the dwelling time based resource scheduling algorithm using Fuzzy Logic in Grid Computing as discuss for resource allocation technique as providing efficient resource allocation in the grid computing is a major task. a simple and proficient fuzzy based resource allocation algorithm is proposed that not only provides efficient allocation of resources but also ensures high utilization of the resources which are dynamic. The proposed technique constitutes of three different stages namely classification of grid resources, generation of fuzzy rules, and resource allocation based on those fuzzy rules.

[6] In this work author said the hierarchal load balancing in computational grid as hierarchical load balancing algorithm which addresses two important aspects, namely multiple parameters based Load Balancing (MPLB) and job

scheduling at Logical Hierarchical Levels (LHL). First we proposed a dynamic load balancing technique over a tree based grid model and demonstrate the efficacy of Hierarchical Job Scheduling (HJS) approach over Flat Structure Job Scheduling (FJS).

[7] In this title author proposed a two-level load balancing policy for the multi-cluster grid environment where computational resources are dispersed in different administrative domains or clusters which are located in different local area networks. The proposed load balancing policy takes into account the heterogeneity of the computational resources. It distributes the system workload based on the processing elements capacity which leads to minimize the overall job mean response time and maximize the system utilization and throughput at the steady state. To evaluate the performance of the proposed load balancing policy, an analytical model is developed.

IV PROPOSED METHODOLOGY

In this paper we modified the process of computational grid computing job allocation and resource allocation process. For the allocation of Job and resource there is no any standard method for the execution of task. In normal case computational grid used first come first allocation technique (FCFS). In the case of FCFS technique the failure of Job is very high and all cases the performance of grid computing is degraded. Now a day's various authors used a heuristic and meta-heuristic function for the improvement of computational grid.

The process of computational grid is very complex and allocation of job is very poor, such reason used multi-condition resource job allocation process. The process of job allocation system define a new constraints set of resource allocation.We used optimization process of grid task scheduling process for computational Grid systems try to give better solutions for the selection and allocation of resources to current tasks. The scheduling optimization is very significant because the scheduling is a main house block for making Grids more available to user communities. Performance prediction is also used in optimizing the scheduling algorithms.

Proposed Algorithm:

- Let n is the no. of jobs (j1, j2, and j3… jn).
- Let m is the no. of resource (r1,r2,……., rm)
- Compute the pheromone indicator value.
- For each resource obtain the information like bandwidth, computing capacity and current load from GIS.
- For each job obtain the job size and the time needed to complete to complete the job.
- Create grid matrix for the process and apply create ant.

Generate the initial population of job and apply the TLBO selection mechanism to select the optimal jobs from population. The selection of job is done using teacher function evaluation.

$$F(xi) =$$

Where f (xi) is the teacher of individual xi and F (xi) is the total pheromone of that individual Job selected. Here in the process of new teacher generation used the teacher factor value=1. Calculate local pheromone and set process priority order for completion of job. If selected job priority is high, then execute the job.

- After execution of job global pheromone are updated.
- Again select population from ant and repeat the process until all jobs are processed.
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The key idea of selection operator is to give preference to better individuals by allowing them to the pass on their genes to the next generation and prohibited the entrance of worst fit individuals into next generation; here we are using genetic approach to only select the job not to find the solution for scheduling.

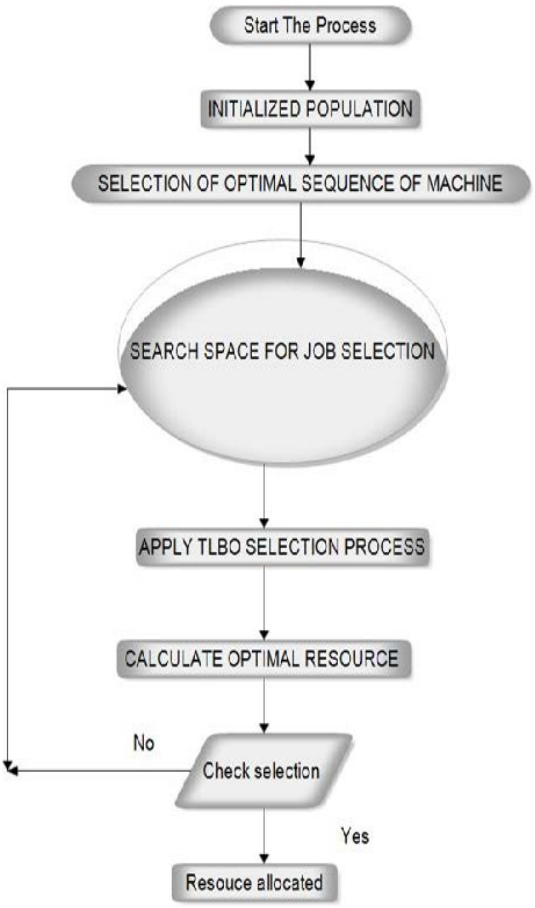

Figure 1: Proposed Model of Resource Job Allocation.

V IMPLEMENTATION DETAILS AND RESULTLT ANALYSIS

In this section we discuss about the implementation details and result analysis. Here in this paper we proposed an adaptive job scheduling for computational grid for resource allocation and job completion. Our job selection mechanism is inspired with genetic algorithm and the search a job for process allocation is ant colony optimization. The combination of ant and GA perform better. The evaluation of performance of proposed method we used MATLAB software and grid model. We create 6 *6, 10*10 and 20*5 grid model for simulation task. For experimental task some standard parameter are used such as resource characteristics and job characteristics.

Small Job (MC-ACO)			
No. of Jobs	**No. of Resources**	**Job Failure Rate**	**Job Completion Rate**
10	5	6.166667	99.166667
20	10	5.000000	86.500000
30	15	5.000000	86.833333
40	20	4.000000	83.000000
50	25	5.000000	85.833333
60	30	5.333333	87.333333
70	35	4.500000	84.833333
80	40	4.000000	83.500000
90	45	4.500000	82.333333
100	50	4.500000	82.333333

Table 1: Job Failure and Job Completion Rate of small job for MC-ACO.

Small Job (MC-TLBO)			
No. of jobs	**No. of Resources**	**Job Failure Rate**	**Job Completion Rate**
10	5	2.0000	91.166667
20	10	4.5000	95.333333
30	15	4.3333	96.166667
40	20	2.0000	90.000000
50	25	3.0000	89.666667
60	30	6.6666	95.666667
70	35	3.0000	86.166667
80	40	3.5000	86.000000
90	45	3.0000	90.500000
100	50	3.5000	87.333333

Table 2: Job Failure and Job Completion Rate of small job for MC-TLBO.

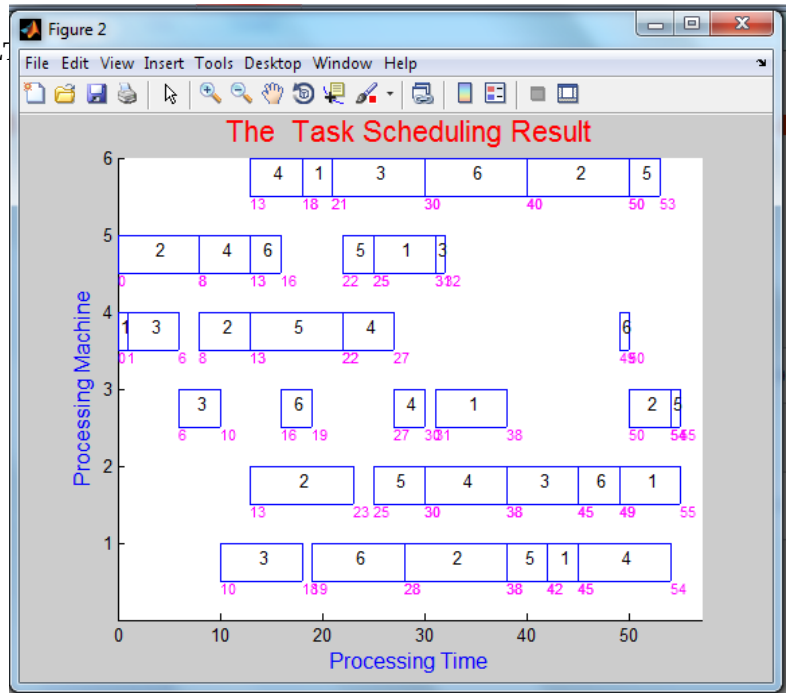

Figure 2: Task Scheduling Result for MC-ACO.

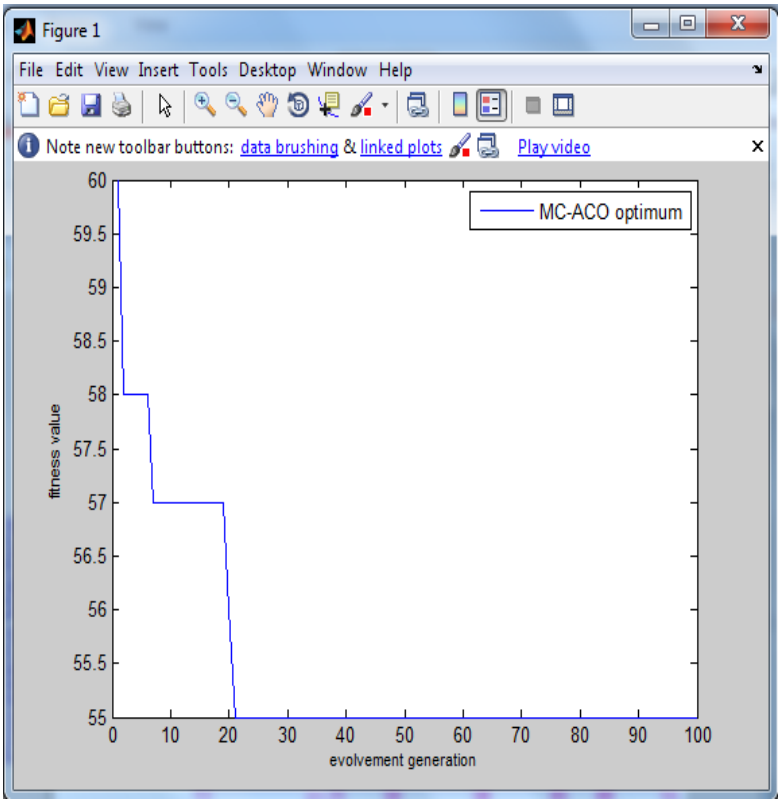

Figure 3: Plotting diagram of MC-ACO.

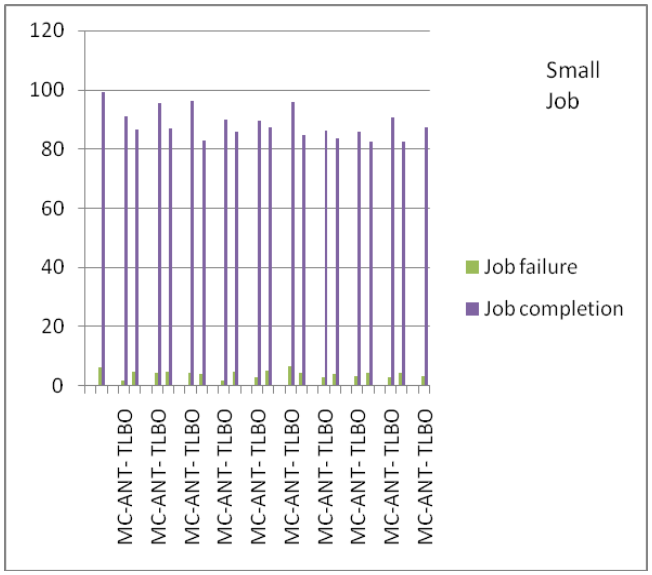

Figure 4: Comparative result analysis of Small job for all method of job scheduling.

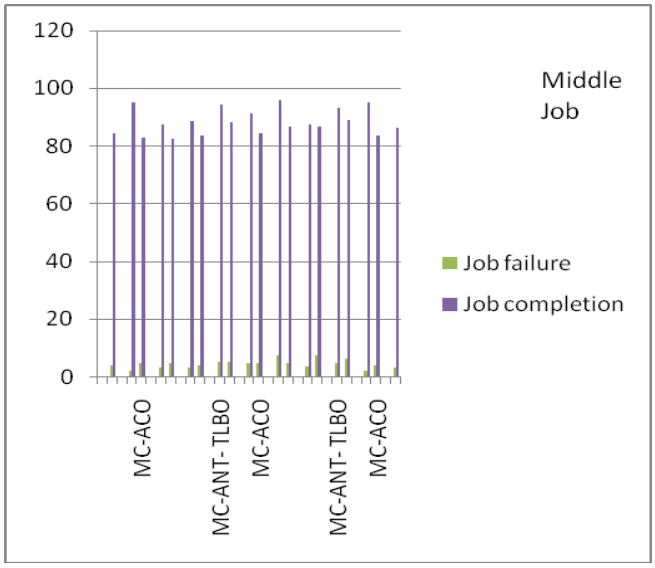

Figure 5: Comparative result analysis of Middle job for all method of job scheduling.

VI CONCLUSION AND FUTURE WORK

In this paper we proposed a novel method for job scheduling in grid computing using ANT-TLBO. We analyze the results in research and put forward a new grid task scheduling strategy. The grid task scheduling algorithm based on the use of genetic algorithm and ant colony algorithm achieves better results than the grid task scheduling algorithm only built on ant colony algorithm. We expect this algorithm is applied to the actual task of scheduling grid, to obtain a more reliable and effective results rather than built on the model on the basis of a priori In order to test our proposed algorithm, we vary the number of jobs submitted to grid. Grid performance is design as 10 * 10, 20*5 and 6 *6 scheduling problem. Increasing the efficiency of computational grid used teacher learning based optimization technique for selection of job in multi-criteria ant colony optimization algorithm (MCACO) for grid scheduling. Some point discusses in consideration of job failure, job completion and make span time.

The usability and application of computational grid are important factor in current scenario of distributed computing and cloud computing. The processing heart of both technologies is computational grid. The success story of computational grid depends on the resource allocation and task scheduling. In this paper we used ANT-TLBO selection process for task scheduling and resource allocation, theses method is very efficient for that process. In future we minimized the process cycle of ANT-TLBO algorithm for improvement of execution time of task.

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