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Mobility Aware Group-Based Job Scheduling Algorithm in Moile Grid Computing

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Abstract: In mobile grids Job scheduling and Load Balancing are the Challenging tasks in unreliable communication environment. The Mobility aware Group-Based Job Scheduling Algorithm(MAGJSA) is used to reducing the energy consumption and efficient job scheduling. The jobs are collected from different users and those jobs are grouped by their resource. The grouped jobs are divided into number of sub tasks based on the priorities. Finally, the jobs are scheduled by considering the mobility, resource availability, job completion time and energy. In proposing MAGJSA method, mobility aware energy efficient job scheduling is carried out by utilizing the genetic algorithm. The proposed MAGJSA method makes use of mobility prediction algorithm to obtain the accurate mobility about mobile users and grids. By performing effective job scheduling, response time to get a required service from the mobile grid is reduced significantly.

Key words: Grid Computing · Genetic Algorithm · Job Scheduling · Resource Availability · Mobility

INTRODUCTION

Grid computing is a computer network where each computer's resources are able to share with any other computer. These resources include processing power, main memory and storage capacity, which are shared by the authorized users to perform specific tasks. Hence, a grid computing system is said to be a collection of similar computers that are executed on the same or different operating systems. In the mobile Grid environment, mobile devices act as both resource consumer and a service provider limited battery life.

Jobs are referred as the programs that run at a specific point on the grid in a parallel manner. Effective job scheduling is achieved by considering the mobility and resource availability with job completion time. There are three main steps in Grid computing that include resource discovery, resource selection and scheduling. Before performing effective job scheduling, the jobs are grouped based on the mobility and resource available to provide better performance.

Problem Definition: Resource availability was considered in order to deal with the workflow tasks with the help of Adaptive Workflow Scheduling algorithm. However, dynamic resource availability was not obtained based on the current running tasks and remaining unexecuted tasks. Group-based Parallel Multi-scheduler was utilized to achieve Grid scheduling by dividing the jobs and machines and forming the groups that are scheduled in a parallel manner. However, resource availability and job processing time were not taken into account while grouping the jobs. Effective Grid scheduling algorithms were developed that perform job grouping based on their priorities before scheduling. Though, energy consumption for completing the jobs was not minimized effectively.

Objective: To achieve minimum energy consumption and response time, Mobility Aware Group-Based Job Scheduling Algorithm (MAGJSA) is proposed.

Literature Review: In [1], efficiency of Grid scheduling algorithms was improved by performing the job grouping according to their priorities and also performing Grid machines grouping according to their configuration before applying the scheduling algorithm to the groups. However, the issues related with energy consumption for completing the jobs remained unaddressed. Centralized job schedulers [1] were developed in order to utilize the clusters of mobile resources by considering the connection time. Although energy consumption is minimized, response time for the users to be serviced was not reduced significantly.

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Knowledge-free, speed-aware and power-aware grid scheduling algorithms were developed in [2] by considering the approximation factor and energy consumption. Though, job scheduling efficiency was not improved to an extent.

Two-phase scheduling technique was introduced in [3] in order to deal with the CPU-intensive jobs on mobile devices by integrating the energy-aware and job stealing criteria. However, scalability was not taken into account for improving system performance.

Group-based Parallel Multi-scheduler (GPMS) [4] was employed to perform Grid scheduling by dividing the jobs and machines to form the groups. Jobs from those groups are scheduled in parallel manner to improve the system performance. Though, resource availability was not considered while grouping the jobs.

Proposed Methodology: Mobility Aware Group-Based Job Scheduling Algorithm (MAGJSA) is developed to achieve minimum response time and energy consumption during group based job scheduling in mobile grids. Information related to various jobs from different users is collected to group those jobs based on the resource availability. Grouped jobs are then divided into a number of sub-tasks which are allocated with some priorities. These jobs are scheduled in the proposed MAGJSA method according to the mobility, resource availability, job completion time and energy. Mobility prediction algorithm is used to obtain the accurate mobility about mobile users and grids. Mobility aware energy efficient job scheduling is performed with the help of Genetic Algorithm. Experimental results show that, the proposed MAGJSA method provides better performance in terms of job scheduling efficiency, response time and energy consumption.

A proposed MAGJSA method first performs Jobs grouping based on mobility, resource availability and job completion time. Then effective job scheduling is achieved using Genetic Algorithm with scheduling priorities to minimize the energy consumption.

Mobility Aware Group-Based Job Scheduling Algorithm (MAGJSA): Mobility Aware Group-Based Job Scheduling Algorithm (MAGJSA) is proposed with the objective of reducing the energy consumption while performing group based job scheduling in mobile grids. Initially, information about various jobs from different users is collected and those jobs are grouped by measuring the resource availability. Then, grouped jobs are divided into a number of sub-tasks which are allotted with priorities. Finally, the jobs are scheduled by considering the mobility, resource availability, job completion time and energy. In proposing MAGJSA method, mobility aware energy efficient job scheduling is carried out by utilizing the genetic algorithm. The proposed MAGJSA method makes use of mobility prediction algorithm to obtain the accurate mobility about mobile users and grids. By performing effective job scheduling, response time to get a required service from the mobile grid is reduced significantly. Figure 4 illustrates the architecture of the proposed MAGJSA method.

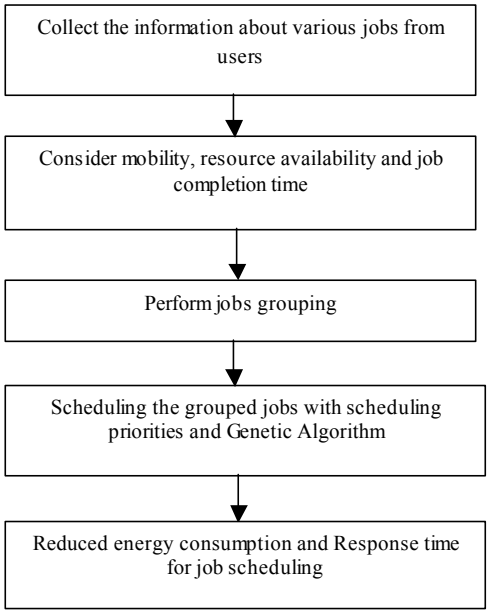

Fig. 1: Architecture of proposed MAGJSA method

As shown in Figure 1, the proposed MAGJSA method performs job grouping followed by job scheduling by considering the metrics such as mobility, resource availability and job completion time to improve the system performance. Therefore, energy consumption for job scheduling gets minimized in an effective manner.

Measurement of Resource Availability and Mobility: In proposed MAGJSA method, Resource availability (RA) is measured when the user utilizes the system instantly at a specific time. Resource availability is ratio of predicted uptime to the sum of predicted uptime and downtime. Uptime and downtime represents the system power status such as ON and OFF respectively.

$$RA = \frac{T_u}{T_u + T_v} \quad (1)$$

From equation (1), 'T_u' Refers to the predicted uptime and 'T_v' refers to the predicted downtime. Here, 'T_u' is further divided into time during which a network is connected 'T_c' and time during which a network is disconnected 'T_{dc}'. Mobility (MO) is measured with the help of two parameters such as access point prevalence 'α_{ij}' and user persistence 'μ_{ij}'. Access point prevalence is measured as shown in the following equation.

$$a_{ij} = \frac{T_{ij}}{T_c^i} \tag{2}$$

After that, user persistence is measured as time duration at which the ith user remains in jth access point 'T_{ij}' until the user moves to another access point (AP) or when the network link is down. User persistence is measured as shown in the following equation.

$$\Sigma_{k=1}^{n} \mu_{ij} = T_{ij} \tag{3}$$

From equations (2) and (3), if the access point prevalence and user persistence are higher, then the mobility is minimum. Based on these measured Resource availability and Mobility, the jobs are grouped and scheduled as follows.

Group-Based Job Scheduling: First, the user creates a job list in the user machine. Followed by resource availability information is obtained. Resources and jobs are sorted in descending order of their processing power and job length respectively. First Come First Serve (FCFS) order is followed to select the resources. After grouping the jobs based on resource availability, Genetic Algorithm is utilized to achieve Group-Based Job Scheduling. Fitness function 'F_i' of the chromosome or individual is measured by utilizing the mobility, resource availability and job completion time as shown below.

$$F_i = \beta_1(T_{JC}) + \beta_2(RA) + \beta_3(MO) \tag{4}$$

From equation (4), 'T_{JC}' represents job completion time, 'RA' refers to the Resource Availability and 'MO' represents the mobility. Here β_1, β_2 and β_3 are known as transformation probability obtained from Poisson distribution. These measured fitness values are updated to the individual. The following steps involved in Genetic Algorithm as follows.

Step 1: Begin

Step 2: Collect the information about arious job from users

Step 3: Perform the job grouping to consider mobility, resource availability and Job completion time.

Step 4: Create an initial population that includes randomly generated individuals

Step 5: Evaluate the fitness of each individual using equation (4)

Step 6: Select the parents from the population

Step 7: Perform crossover operation

Step 8: Perform mutation

Step 9: Apply the scheduling priorities

Step 10: If the optimal solution obtained

Step 11: Stop the operation

Step 12: Else go to step 5

Step 13: End

The above Genetic Algorithm is utilized in the proposed MAGJSA method in order to achieve optimal solutions on job scheduling with minimum response time. Scheduling priorities are provided based on the mobility, resource availability and job completion time. Energy consumption is reduced by effectively scheduling the grouped jobs in proposed MAGJSA method.

Energy Consumption: Energy consumption is measured as the amount of utilization of energy while scheduling the jobs of mobile users. Energy consumption is measured in terms of Joules. If energy consumption is low, then the method is said to be more efficient.

Table 1 shows energy consumption with respect to number of user requests for different proposed and existing methods. The input, number of user requests is taken from the range of 5 to 50 for conducting experiment. From Table 1, it is clear that for the increase in number of user requests, energy consumption is also increased for all methods. Among these methods, proposed MAGJSA method provides better performance in terms of reducing energy consumption when compared to other proposed and existing methods.

Figure 2 demonstrates the measure of energy consumption is compared with the IGAGJS and MAGJSA. From Figure 3, it is evident that proposed MAGJSA

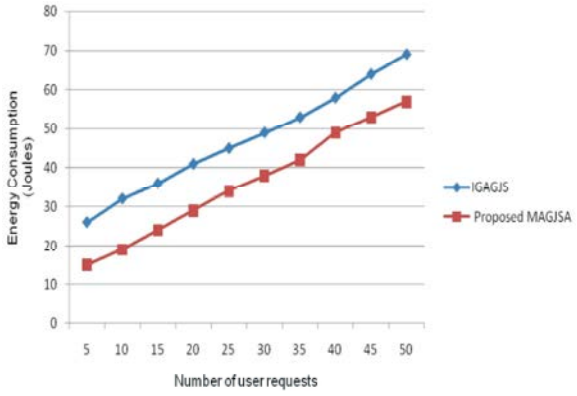

Fig. 2: Measure of energy consumption

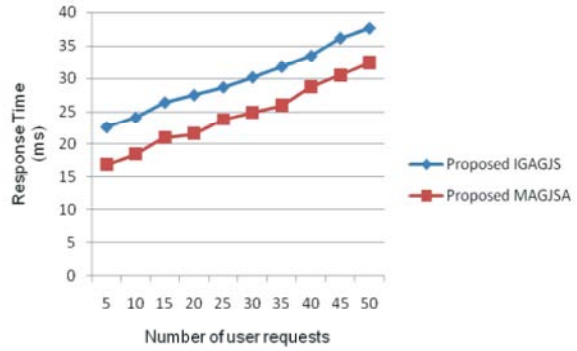

Fig. 3: Measure of response time

Table 1: Tabulation for energy consumption

Number of user requests	Energy consumption (Joules)	
	IGAGJS	Proposed MAGJSA
5	26	15
10	32	19
15	36	24
20	41	29
25	45	34
30	49	38
35	53	42
40	58	49
45	64	53
50	69	57

Table 2 Tabulation for response time

Number of users	Response time (ms)	
	Proposed IGAGJS	Proposed MAGJSA
5	22.6	16.8
10	24.1	18.4
15	26.4	20.9
20	27.5	21.5
25	28.7	23.7
30	30.2	24.8
35	31.8	25.9
40	33.4	28.7
45	36.1	30.5
50	37.6	32.4

method effectively reduces the energy consumption when compared to IGAGJS methods. This efficient reduction of energy consumption in proposed MAGJSA method is achieved by performing effective job scheduling with the help of Genetic Algorithm with scheduling priorities. Priorities are obtained based on mobility, resource availability and job completion time.

Impact of Response Time: Response time is measured as the product of time taken to give the response from grid after scheduling with respect to number of Grid users. Response time is measured in terms of milliseconds (ms). If response time is low, then the method is said to be more efficient.

Table 2 shows the tabulation for response time in terms of number of users using different proposed and existing methods. The input, number of user requests is taken from the range of 5 to 50 for conducting experiment. From Table 2, it is clear that for the increase in number of users, response time is also increased for all methods. Among these methods, proposed MAGJSA method provides better performance in terms of reducing the response time when compared to other proposed and existing methods.

Figure 3 illustrates the measure of response time for proposed IGAGJS, MAGJSA and AGAVRM methods which are compared with the existing methods such as Priority method [1] and IEGDC method [5]. As shown in Figure 10, proposed MAGJSA method effectively reduces the response time when compared to other methods. This efficient reduction of response time in proposed MAGJSA method is achieved with the help of effective job scheduling by using Genetic Algorithm.

REFERENCES

1. Goodhead Tomvie Abraham, Anne James and Norlaily Yaacob, 2015. Priority-grouping method for parallel multi-scheduling in Grid, Elsevier, Journal of Computer and System Sciences, 81(6): 943-957.
2. Matías Hirsch, Juan Manuel Rodriguez, Alejandro Zunino, Cristian Mateos, Battery-aware centralized schedulers for CPU-bound jobs in mobile Grids, Elsevier, Pervasive and Mobile Computing, 29: 73-94.

3. Andrei Tchernykh, Johnatan E. Pecero, Aritz Barrondo and Elisa Schaeffer, 2014. Adaptive Energy Efficient scheduling in Peer-to-Peer Desktop Grids, Elsevier, Future Generation Computer Systems, 36: 209-220.
4. Goodhead, T., 2015. Abraham, Anne James, Norlaily Yaacob, Group-based Parallel Multi-scheduler for Grid computing, Elsevier, Future Generation Computer Systems, 50: 140-153.