A New Hybrid Algorithm to Solve the Task Scheduling Problem in Grid Computing

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ABSTRACT

The new generation of networks, distributed systems, grid computing, which allows users to share files and Users need to use different sources to provide. Grid computing system as one of the competing technologies for cloud computing can be considered to have many advantages for users. One goal of grid computing systems, the management of computing resources for processing user applications or clients So that the resulting high quality of service, lower costs and greater flexibility is. In this paper, to solve the scheduling problem in grid computing system combining genetic algorithms and algorithms of gravity is used.

General Terms

Grid scheduling

Keywords

Grid computing systems, Genetic algorithms, Algorithms gravity

1. INTRODUCTION

Grid computing system is the new generation of distributed networks that allows users to share files and provides users need to use different sources. Grid computing system is considered as one of the technologies competing for the supercomputer that can have many benefits for users. Nowadays grid as a model for solving problems in science, engineering, industry and trade are discussed. With the increasing number of users in such problems, the grid computing and storage resources for other needs have been resolved [1].

One goal of the Grid Computing Management of computing resources for processing user applications or clients that lead to high-quality services at lower costs and greater flexibility is [2]. With the increase in grid computing resources to Grady system is felt that to be able to manage this kind of resources to quickly respond to various requests. Therefore, users work schedule for processing by the appropriate resources in grid networks, as a fundamental issue in achieving high performance in grid computing systems have been proposed network. However, the design and implementation of efficient algorithms for scheduling tasks of an application as a problem NP Complete in the network Grid computing is becoming a big challenge [3].

What are the different types and grades into different Barmhasbaty. The objective of Grid scheduler, the optimal assignment of tasks to resources. Today, with the growing importance of the issues to quickly find answers, solve many problems not amenable to traditional methods of random search algorithms over a comprehensive search of the issue will be used. At present innovative algorithms that are used

for grid scheduling problem, generally, genetic algorithms, simulated refrigeration, hybrid genetic algorithms and simulated refrigeration, unlawful search, colony ant colony optimization, and the optimization of birds.

GA algorithm to schedule the work of the late 1990s in a heterogeneous computing environment has been used [4]. Braun and colleagues conducted a comparison between eleven static algorithms [5]. Their simulations showed that GA consistently obtains the best solution compared to other algorithms. In 2007, Mr. Carretero and colleagues a valuable study on the benefits of GA to design of efficient grid scheduler, with the goal of minimizing Makespan and workflow offered [6]. In 2008, Yuan an improved adaptive algorithm combining GA with neighborhood search is introduced, and simulations show that the proposed algorithm can the performance of scheduling dramatically improve Grid [7].

Fidanova job scheduling algorithm based on SA algorithm is presented that achieves better results as compared to ACO[8]. In 2008, Kazem and his colleagues a modified SA for scheduling independent tasks in Grid environment was provided[9]. Experimental results show that this algorithm is compared with the results of other algorithms in the paper were obtained; it can improve the performance of a static samples. In 2006, Zheng and his colleagues, a parallel algorithm GSA, GA and SA which combines the advantages of the proposed Grid scheduling problem [10].

In this paper, a new hybrid algorithm combining genetic algorithm and algorithm to solve scheduling tasks in the network gravity grid computing is proposed.

Rest of the paper is structured as follows: in Section 2 with a description of the proposed Grid network is presented. Procedures set forth in Section 3 and Section 4 of the proposed algorithm and experimental results are shown comparing the proposed algorithm with Genetic Algorithms. In Section 5 the conclusions expressed.

2. Description of the problem

In grid environment is presented in this paper, there are N sources; each of these sources can be located anywhere in the geographical environment. Each source is composed of a number of machines per machine processor to process data from a number of different perks and a different kind of performance has been established. For example, a car may be a server that contains multiple processors, and each processor has its many perks, it is also a car can be a processor with different performance. In addition, each processor has a different fee for processing information. Processors using the communication channels they are connected with the car. Finally, all of these resources to the grid scheduling system

are connected through a communication channel. Properties considered in Table 1 for the sources listed.

Table 1. Properties considered for resource

Source	Machine	Processor
Bandwidth used to receive and transmit data	The operating system of the machine	Power processors based on MIPS
Machine list provided by the supplier	Machine architecture, such as Intel, Mac and ...	Find the cost of work done per second
Geographical area source	List of available processors	Percent of the perks of working days
		Percent of the processing power on holidays
		Percent power at other times, such as midnight

In this environment, grid users by their requests to different outgoing rate a file system to a Grid scheduler, Grid scheduling system using the scheduling algorithm, the users do the allocation of resources for the processing of deals. Each user for the processing of your actions, proposed completion time and cost of the proposed works. The scheduling algorithm, the users work in minimum possible time and with less cost. After scheduling tasks by scheduling algorithm and their implementation on grid systems, processed information is sent to the user. The parameters considered for application users and their tasks are shown in Table 2.

Table 2. Parameters intended for users and applications work

Application tasks	User
Number of work orders requested by the millions	Do list
The file size of the requested user	Total processing time for the proposed work
Type of work required operating system user request	Suggested price for the whole process works
Find business application The kind of architecture requirements	User geographical area.
	The priority parameter "suggested time"
	Priority parameter "price"

The system works in a off-line users and is not intended to limit the user's work process. Each processor works on the operating system and its associated processing architecture and the processor does not halt, The CPU time allocated to a task, the processor at the end of the process will work.

3. The proposed algorithm

In this paper, to solve the scheduling problem in grid computing system combining genetic algorithms and algorithms of gravity is used. Table -3 of the proposed algorithm on grid computing system model has been implemented. The grid system with two sources, each of which has two machines, and each machine has two processors is to process things.

Table 3. Basic information of resources in Grid computing model.

Sources of Information			Machine Information		Information Processor						
Source name	Transfer rate	Geographical area.	Machines name	Type of operating system	The kind of architecture	Processor Name	Throughput	Cost	Maximum throughput available		
R1	50	+03:30	M1	Windows	Intel	P1	10	1000	50%	90%	30%
						P2	25	2500	45%	50%	25%
			M2	Unix	IBM	P1	30	3000	55%	80%	60%
						P2	10	1500	70%	89%	50%
R2	70	+03:00	M1	Windows	IBM	p1	20	2000	30%	70%	40%
						p2	35	3000	60%	95%	15%
			M2	Linux	Intel	p1	15	1500	30%	90%	25%
						P2	40	4000	40%	90%	35%

Basic information related to the users are shown in Table 4. In this table there are three users, each user profile to work

offline has been sent to the grid scheduling system Samples processed by the CPU to be placed on the grid system.

Table 4. Basic information of users in the Grid computing model

work the information							Information users				
User name	Transmission rates	Suggested fee	Suggested time	First time	Spending prioritizing	Geographical area	Number of work	work size	Number of orders	Kind operating system	Kind of architecture
U1	30	1000	200	7.0	3.0	+03:30	1	50	150	windows	Intel
							2	35	80	Unix	IBM
							3	8	20	windows	Intel
U2	45	9000	180	4.0	6.0	+03:30	1	18	50	Linux	Intel
							2	25	60	Unix	IBM
							3	43	100	Unix	IBM
U3	60	1500	150	5.0	5.0	+03:00	1	5	15	windows	Intel
							2	20	55	windows	IBM
							3	30	70	Linux	Intel

In the proposed algorithm to identify the best sources and processors of Table -3 is used for data encoding. Available sources of information for indexing CPU encoding is used, so that the new coded for each of the processors is considered a unique index. For example, an index number in Table II processor machine coded in the source notes And index number four the number of processors in a machine, a second source suggests. Table 5 shows how the coding in Table 3, each row of the table refers to the processors used in Table 3.

Table 5. Sources encoded in the grid computing model

Number of rows	Resource name	Machines name	CPU Name
0	R1	M1	P1
1	R1	M1	p2
2	R1	M2	P1
3	R1	M2	P2
4	R2	M1	p1
5	R2	M1	P2
6	R2	M2	P1
7	R2	M2	p2

In the proposed algorithm to identify the best practices of coding work table is used. Each row of the table of user actions referred to in Table 4. The following table (6) how the code works, in Table 4 show.

Table 6. Coding jobs in the Grid computing model

Number of rows	User name	Number of work
0	U1	1
1	U1	2
2	U1	3
3	U2	1
4	U2	2
5	U2	3
6	U3	1
7	U3	2
8	U3	3

3.1 Chromosome Structure

In the proposed algorithm to display the total number of jobs available in the chromosome of one-dimensional array is used for processing. Chromosome is composed of two fields, each home to UT_i and PU_i are shown. PU_i First field to cpu number i, the source table is encoded And second field UT_i , the i, the table refers to the encoding tasks.

2,0	6,1	8,7	0,0	1,3	7,4	5,2	3,6	4,3
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Figure 2. Structure of the proposed algorithm chromosomes

As you can see from the structure of chromosomes in Figure 2, each number in the array, the number of work that must be processed by the CPU shows. For example, the gene content of 1, 6 is, in fact, 6 of the table refers to the encoding tasks that should CPU 1, which is encoded in the resource table, to be processed. In the proposed algorithm, each chromosome represents a schedule for all the tasks users.

3.2 Merit

Chromosome Merit in the proposed algorithm to reduce the completion time of all tasks to process scheduler in Grid computing systems and improve work processes so that users need to be fully considered by the parties. Users Equation 1 is used to calculate a Merit.

$$F_j = \left(\frac{CT_j}{OP_j} * PC_j \right) + \left(\frac{TT_j}{OT_j} * PT_j \right) \quad (1)$$

In the above equation P_j , the cost is intended for user j, OP_j represents the total processing cost of the proposed works is the user j, And CT_j represents the estimated costs to process user jobs on Grid Scheduling System j and PC_j indicates priority intended for user j is the cost.

Also T_j , is intended for time user j, OT_j represents the total processing time of the proposed work is the desired user j and TT_j , shows the computation time for processing user jobs on Grid Scheduling System j and PT_j represent preferences intended user j, for a time.

The merits of a chromosome, the proposed algorithm Merit total completion time of all users and for Grid scheduling system to process all things are considered, Whatever the Merit of the chromosome, the chromosome with the lower Merit is better. Equation 2 is used to calculate the Merit of the chromosome.

$$Fitness = \sum_{j=0}^j F_j \quad (2)$$

3.3 Population Optimization

At this stage the chromosomes selected for transfer to the next generation by using gravity algorithm improved the percentage of the population of chromosomes as the new children are added to the population.

In the proposed algorithm, the number of chromosomes in a loop selection and ranking algorithms using the gravitational force is called for. Chromosomes in each iteration of the genetic algorithm gravitational force as a solution to current

CU received and applied to optimize multi-stage operation in which the chromosomes.

The gravitational algorithm proposed method is to first search the problem space neighborhood of the current solution is created The combination of the first two methods are used to calculate the gravitational force, To move in the search space of single and multiple combinations are used.

Algorithms defined in the neighborhood of gravity is to the total solution nominated scanned from beginning to end, And most detailed source of data is processed to act shall be selected, Then run a small operation that has changed are randomly selected and the source. In the end, the best answer to the gravitational algorithm genetic algorithm named Best Solution returns.

4. Implementation of the consequences

To test the performance, the proposed algorithm (GAGELS) is compared with the algorithm [GA]. Algorithms are used to implement the programming language C #. Net 2010. Algorithm on a computer with a processor Intel (R) Pentium (R) 4 CPU 3.00GHz and 2.00GB RAM will run. To compare these two algorithms designed 10 sets of test data to the grid system of small, medium and large covers. Each test case where N represents the number of Test N_DAY test Day to day, and that the test set will be processed in a grid network show, The test data set is shown in Table 7.

Table 7. Data collection was designed to test

test data	Specification tests designed										
	Members Profile						Range profile of each work				
	User number	Transmissions rates	Suggested cost	Suggested time	prioritizing time	Spending prioritizing	Geographical area	Number of work per user	Each work size	Number of job orders	Kind operating system
Test 01_W	40	[64,128]	[1000,2000]	[200,400]	0.7	0.3	GMT Interval	[2,7]	[400,500]	[2000,4000]	[1,2]
Test 02_H	42	[128,200]	[1500,2500]	[300,400]	0.8	0.2	GMT Interval	[2,7]	[600,800]	[2500,3600]	[1,3]
Test 03_W	52	[512,700]	[1000,2000]	[100,300]	0.8	0.2	GMT Interval	[2,7]	[400,500]	[2000,2500]	[1,3]
Test 04_H	65	[256,320]	[2000,3600]	[450,650]	0.6	0.4	GMT Interval	[2,7]	[600,700]	[2000,4000]	[1,3]
Test 05_W	100	[256,490]	[2500,4000]	[600,650]	0.3	0.7	GMT Interval	[2,7]	[650,750]	[2500,4500]	[1,3]

Since each test requires a Model of Table 7 is the Grid Network To works considered in any test processed by processors which are placed in a grid network. For the same set of grid network model, called Model N_GMT is designed Where N represents the number N of Table 7, the model is designed to test the issue. And GMT geographical area intended for grid network show. Table 8 sets designed to model test data in Table 7 shows.

Table 8. Model set design

Designed model number	The design model specifications for each test data										
	Range profile of each source			Range profile of each machine			Range profile of each processor				
	Number of Source	Transmissions rates	Geographical area	Number of machine	Kind operating system	Kind of architecture	Number of CPU	Throughput	Cost	Range maximum throughput available	
Model 01_+05:30	1	[32,64]	GMT Interval	2	[1,2]	[1,2]	4	[40,50]	[50,65]	[55,65]	-
Model 02_+04:00	2	[64,120]	GMT Interval	3	[1,3]	[1,2]	8	[60,80]	[75,85]	-	[80,95]
Model 03_+06:30	2	[400,500]	GMT Interval	5	[1,3]	[1,3]	11	[80,75]	[80,80]	[55,65]	-
Model 04_+06:30	2	[128,256]	GMT Interval	4	[1,3]	[1,2]	8	[80,80]	[95,105]	-	[90,100]
Model 05_+06:00	5	[256,512]	GMT Interval	10	[1,3]	[1,2]	19	[90,95]	[70,90]	[60,60]	-

As shown in Table 8 for the total number of parameters designed to test the performance of the proposed algorithm is further studied. For example, in Table 7 on the grid system model, Test 01_H is designed with the Model 01_ +06:00, from Table 8 will be tested.

4.1 Results of the simulation

In Table 9 the results of the proposed algorithm for testing data are shown in Table 7.

Table 9. Results of the proposed algorithm

Test data	Genetic Algorithms				Suggested algorithm			
	Number of generations	Best fitness	Best Runtime	Best of breed	Number of generations	Best fitness	Best Runtime	Best of breed
Test 01_W	200	645.80000 5674362	478	190	200	746.80000 4005432	18	195
Test 02_H	200	253.00000 3769994	288	126	200	262.60000 3913045	15	178
Test 03_V	250	317.00000 4723668	365	126	250	339.20000 5054474	25	224
Test 04_H	300	285.80000 6729364	778	219	300	289.40000 6630692	31	231
Test 05_V	400	592.49999 6125698	2001	344	400	599.39999 5803833	91	374

Figure 5 compares the two algorithms are fitness diagram shows the test data using the collection Test 02_H. As shown in Figure 5, the proposed algorithm is always better solutions than the algorithm in the GA.

Figure 5. diagram comparing the fitness the proposed algorithm with GA Algorithms for Test Data Test 02_H

Figure 6, diagram fitness comparison algorithm using two test datasets Test 05_W shows. As shown in Figure 6 is shown the proposed algorithm to test the algorithm, GA is always a better solution.

Figure 6. diagram comparing the fitness the two algorithms using datasets Test Test 05_W

5. Conclusion

In this paper, a new method using gravity algorithm combines genetic algorithms and a system for grid scheduling problem is proposed. Proposed algorithm with genetic algorithm in powerful local search was combined gravitational force, the proposed algorithm is more efficient in achieving the optimum solution. It also has been trying to answer at the

right time can achieve a higher quality. Eight different test data to evaluate the performance of the proposed algorithm, the proposed algorithm is designed for large and medium and small issues can be discussed. Experimental results show that the proposed algorithm in solving grid system has high speed and able to create a balance between users' criteria. Future work could affect the diversity of the population and prevent the convergence of the genetic algorithm on the solution quality of the proposed algorithm to solve the problem. Think of it as a priority for the allocation of resources to tasks.

6. REFERENCES

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