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Research Article

Load Balancing Mechanism in Agent-based Grid

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Abstract

Grid is a computing extensive computational environment that makes the enormous processing power for distributed processing. Grid resource management is important and for agent-based approach is a way to manage its resources. Load balancing is an important section resource management system. Paper model of multilevel load balancing in grid and ARMS environments provided, resource management model provided that the estimate is load node. In the First level of model, using genetic algorithm is used for load balancing nodes between internal resources. That is, in the second level, Add method of the neighborhood and overloaded nodes are added to the rainfall distribution in the limited area around the player.

The third level is the ecosystem is one of the intelligent ants, each method is a method of load balancing. Picking methods In a multilevel structure is called MLBM that eliminates the disadvantages and satisfies the majority of the load balancing properties. The results show that the model is superior to its predecessors gain in increasing productivity and reduction srbarartbaty.

Keywords: Grid, load balancing, ARMS, MLBM

1 Introduction

The main of components of the grid architecture are [1]: Infrastructure grid is composed of resources national grid that can be accessed through the Internet. Resources, include computers, supercomputers, databases and are etc. Grid services offers things, such as information, communication, naming, resource management, security, etc. Grid tools offer high level services, including speech, programming interfaces, development tools and troubleshooting tools. Grid applications include distributed supercomputing applications in a wide range, including computations with high throughput and high volume of data to be included. ARMS is agent-based resource manager for grid computing. operating softwares are computer systems that have the ability of flexible and autonomous functions in unpredicatable environment [1].

In ARMS system, agents work together for resource discovery to. Each agent information resources keeps that manages in the form of tables, called ACT. Agents are equipped with tools to predict the performance

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of the PACE [2]. Due to the lack of a balanced use of resources in the ARMS system load balancing method is used. The purpose algorithms balance the uniformly distributed load on resources and maximize resource efficiency and low overall execution time task [2]. This paper offers, multi-layer load balancing mechanism for ARMS. The model is MLBM and is a three-level model in which each level performs load balancing.

2 Preliminaries and notations

Grid, in terms of environmental and structural conditions,has major differences with its predecessor's distributed systems,as a result it can not load balancing algorithms for distributed systems used in computational grids. Load balancing is an optimization problem and the heuristicare are to achieve relatively good results in a reasonable time. Accordingly, the existing load balancing methods for load balancing heuristic methods are the following: Genetic algorithm is a heuristic efficient load balancing. Foundations A.zomaya and colleagues have examined the use of genetic algorithms for load balancing. The use of collective intelligence that was first proposed by Dorigo as a multi-agent approach for combinatorial optimization problems is presented. Using neural networks, fuzzy logic, intelligent agents using and approximate methods other methods are of research in the field of load balancing. In 2001, ARMS was presented in j.cao doctoral thesis, in the system of resources managerment of the agents that are equipped with a means to Predictive performance of the PACE have been used [3].

3 Main section

3.1. agent-based resource management method (ARMS)

Resource management system is the main components of the grid system and it manages a set of resources that are available to manage.
ARMS makes a bridge for scheduling programs and use of the available resources. The relationship between the components is shown in Figure 1.

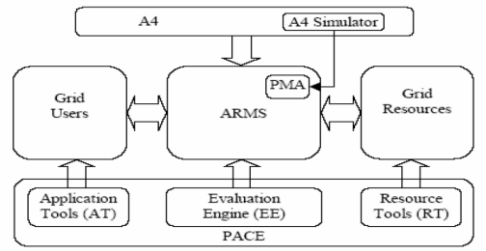

Figure 1: ARMS structure Resource Management Model

PACE: Providing quantitative data on the performance of complex applications running on local resources
AT: A part of PACE in which the program is run by user should have a model, called the AT model
RT: Means any source that provides specific source of the resource model
EE: Or assessment engine to another part of the PACE that performs operations performance evaluation [4].
A4: Used for operations management sources at the operating level and it makes [5] will be operating Agent in a series hierarchical structure.
PMA: The simulator A4 is the main part of it. The task of this agent is monitoring and regulating the behavior of other agents to increase the efficiency of the whole system.

3.2. Existing methods for load balancing

Load balancing method uses genetic algorithm [5] and methods collective intelligence such as methods based on ants.

3.2.1. Using Genetic Algorithms

j.Cao et [6], provided a way for load balancing in ARMS. This algorithm performs load balancing in the node by the scheduler. So that the whole processes can be completed before the deadline, and an efficient way has to implement the processes waiting in a node and from genetic algorithm is used. Figure 2 shows the architecture of the system:

Task Management: request enters this area and queues for schedule be processed by genetic algorithms.

Resource Monitoring: the task of collecting statistical data related to the processors on which work is to be done.

Task Execution: The task of performing a program related to a program on the list of scheduled processors.

PACE Evaluation Engine: Is takes on obtaining data on the time of running processing using the program model and the resource model.

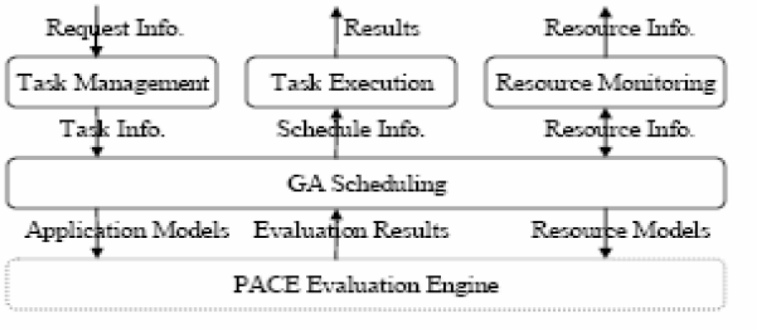

Figure 2: Algorithm architecture in the local management ARMS

3.2.2. Using Collective Intelligence

An algorithm, called Messor, was presented for load balancing in grid [7] ants can be placed in the states of Search-Max and Search-Min during their life in this system. In the states of Search-Max, an ant moves randomly to find an overloaded a node. Then ant goes to the states of Search-Min to find the an underloaded node. Load means the number of elements available in each node. Then ant does the balancing act between two nodes. When the ants move to a node leaves, data about nodes which until then had met for other ants. Ant-based algorithm proposed in ARMS is similar to messor method and acts as follows:

1. An ant goes from one agent to another agent, and tries to remember the characteristics of the factor with high load.

2. After traversing M step and finding an agent with the highest load factor, the ant changes stateand remember characteristics of agent with minimum load.

3. After traversing M step and finding on agent with the minimum load factor, Ant stops one step and proposes load balancing between the minimum and maximum load.

4. After performing load balancing, loop is repeated from step 1.

3.2.3. Methods Of the Scheduler Level

(QAP) methods to set the queue length

In this way, the scheduler places between queue and the processor and performs the of regulation queue length according to adjacent nodes, queue length. As shown in figure 3, if the queue is removed from balance, additional processes are sent to other nodes.

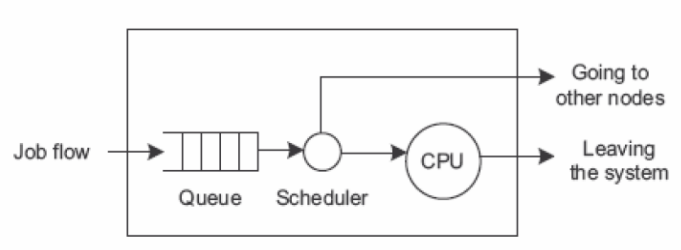

Figure 3: Approach based Regulation queue length (QAP)

(RAP) arrival rate setting methods

In this way, the scheduler places in the arrival of the queue. As shown in figure 4, when a new job enters a node, the scheduler cleanfies that it needs to be processed there or it should
Be sent to another node.

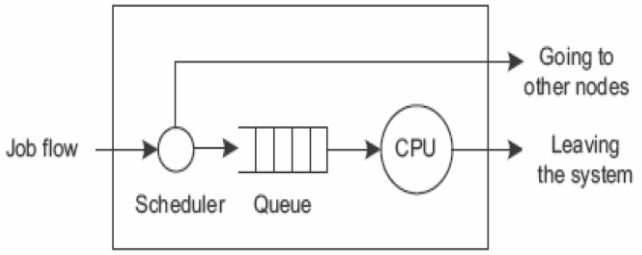

Figure 4: Approach based arrival rate setting (RAP)

(QRAP) combined approach

It is a combination of methods to regulation of queue length and arrival rate setting, that is to say, the scheduler sets jobs arrival rate and queue length at each node.

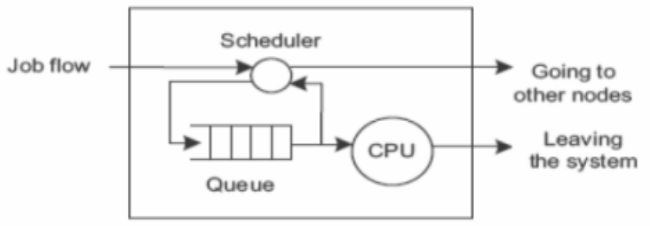

Figure 5: combined approach (QRAP)

3.3. Multilevel load balancing mechanism in the grid computing environment (MLBM)

To overcome the disadvantages of each algorithm, combining algorithms are listed. By the method of genetic algorithm [6], ant algorithm in whole grid and load balancing algorithm in level scheduling provide a new multi-level procedure and this model is called MLBM. In the first phase of the algorithm an optimal way for Processes is expected to run in each node. The second level of the scheduling algorithm acts in implemented scheduler and the neighbors of each node levels that can perform from the beginning load balancing operations processing. This algorithm does not impose much load on the system and performs load balancing at neighboring nodes level with respect to the cost of dehvering node. The third level of ant algorithm is used to balance the load and load is spread between different nodes. Each node periodically gathers information about what the neighbors do. At the same time ants may have passed from the node and if they diagnose rich node or less load is spread, remember to balance it out. If ants remain for consecutive

periods by applying the algorithm to the neighborhood of full load, nodes can build an ant and send it to system. Along with these two algorithms genetic algorithm in the node tries to create an optimal schedule for the node. Since the radius of distribution of neighborhood algorithm level is low to do this ant algorithm is used and weakness is of ants way of increasing the number of ants, therefore, in use of ant algorithms and the neighborhood algorithm, the neighborhood algorithm disperses load in the environment resulting in the use of fewer ants to balance the load. therefore, concomitant use of two ant algorithm causes them to fix flaws.

4 Numerical examples

If we assume that p is the number of agents in the resource management system and the W_{PK} (p: 1, 2, ..., P) load factor P in step K, In this case average workload of the following:

$$\overline{W_k} = \frac{\sum_{p=1}^{p} W_{p^k}}{p} \tag{4.1}$$

Average standard deviation W_{PK} that expresses the level of load balancing is defined as follows:

$$L_k = \sqrt{\frac{\sum_{p=1}^{p} (\overline{W_k} - W_{pk})^2}{p}} \tag{4.2}$$

L_K indicates average of the deviation agents from the overall average W_K. And finally, performance load balancing method is defined as follows:

$$e_k = \frac{L_0 - L_k}{C_k} \tag{4.3}$$

In formula 3 e_k, load balancing performance at step k and C_k has the total number of connections agents to get to L_k. In a trial to performance evaluation the effectiveness of variety is described above. Performance method MLBM is compared with the method based intelligent ant in ARMS. The performance calculated according to the formula (4.3) is compared together at T different times.In this test K=7 is considered.

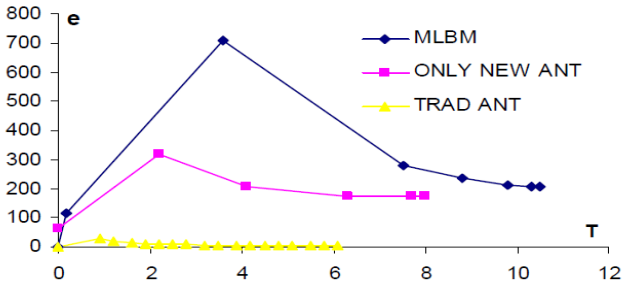

Figure 6: Compare the performance of different methods proposed

According to tests performed (e) method MLBM is more than algorithm based on intelligent ant.

5 Conclusion

MLBM is a multilevel model for load balancing. Its performance occurs at three levels and while the levels are separated, the result is a performance effect. The first level of this model is functioning within a node and with the use of genetic algorithm implementation, In the second level there is neighborhood level load balancing algorithm that is a component of load balancing methods in the level of scheduler and in the third

level an ant algorithm is proposed for load balancing. Interaction of methods in Systems causes loss of flaws and as a result load balancing can be performed with high efficiency.

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