Resource Allocation Mechanism with New Models for Grid Environment

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ABSTRACT

Resource allocation is playing a vital role in grid environment because of the dynamic and heterogeneous nature of grid resources. Literature offers numerous studies and techniques to solve the grid resource allocation problem. Some of the drawbacks occur during grid resource allocation are low utilization, less economic reliability and increased waiting time of the jobs. These problems were occurred because of the inconsiderable level in the code of allocating right resources to right jobs, poor economic model and lack of provision to minimize the waiting time of jobs to get their resources. So, all these drawbacks need to be solved in any upcoming resource allocation technique. Hence in this paper, the efficiency of the resource allocation mechanism is improved by proposing two allocation models. Both the allocation models have used the Genetic Algorithm to overcome all the aforesaid drawbacks. However, one of the allocation models includes penalty function and the other does not consider the economic reliability. Both the models are implemented and experimented with different number of jobs and resources. The proposed models are compared with the conventional resource allocation models in terms of utilization, cost factor, failure rate and make span.

Keywords: Allocation Based on With Penalty Function (AWPF), Allocation Based on Without Penalty Function (AWOPF), Genetic Algorithm, Grid Environment, Resource Allocation

INTRODUCTION

Nowadays, the way of using computers has been changed due to the increasing popularity of the Internet as well as the availability of powerful computers and high-speed network technologies as it is of low-cost commodity components. These technologies provide the chance of using distributed computers as a single, unified computing resource, which is popularly called as Grid computing (Baker et al., 2002). The Grid computing has become an important field in research, which is renowned from conventional distributed computing for large-scale resource sharing. Its main goal is to manage the available resources and turn the fundamental infrastructure into a powerful enterprise for Grid applications (Ismail et al., 2008). The term Grid is selected as an analogy.

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to power Grid that offers reliable, pervasive, consistent, transparent access to electrical energy irrespective of its source (Chetty & Buyya, 2002). In the early days, concept of Grid computing was started as a project to connect geographically distributed supercomputers. However today it has grown to a great distance from its original target. The Grid infrastructure is beneficial for several applications such as collaborative engineering, data exploration, and high-throughput computing (HTC), and distributed supercomputing (Oladosu et al., 2009).

The expansion and deployment of a number of services are necessary to construct a Grid. They comprise low-level services such as security, information, directory, resource allocation, and payment mechanisms in an open environment and high-level services for application development, execution management, resource aggregation, and scheduling (Buyya et al., 2001). Grid allows sharing, selection, and aggregation of a large variety of resources including supercomputers, storage systems, data sources, and specialized devices which are geographically distributed and possessed by diverse organizations for solving extensive computational and data intensive problems in science, engineering, and business (Sumathi & Punithavalli 2008). Management of these resources is an essential infrastructure in the grid computing environment. But, it becomes difficult when the resources are geographically distributed, different in nature, possessed by diverse user or organizations with their own policies, have diverse access models, and have dynamically changing loads and availability (Nandagopal & Uthariaraj, 2010). By offering scalable, secure, high-performance techniques for discovering and allowing access to remote resources, the Grid assures the possibility for scientific collaborations to share resources on an exceptional scale, and for geographically dispersed groups to work together in ways that were formerly not possible (Oghenekaro & Edward, 2008).

In a Grid computing system, the resources are grouped into classes namely, CPU cycles, disk space, memory space, network bandwidth, and specialized processing power. Based on the first-come first-served policy, the scheduler performs the allocation process (Subramoniam et al., 2002). The resource-consuming activities or jobs of a user should be mapped to particular resource providers by a resource allocation mechanism. In order to optimize some useful metric, the resource allocation mechanism may choose alternate mappings. Moreover, allocation mechanisms should be highly scalable and robust to evade failures in resources and communication paths (Galstyan et al., 2005). The allocation of resources is an important issue in both Computer Science and Economics. An allocation means a particular sharing of resources between agents. For example, in the case of non-sharable undividable resources, an allocation is a partition of the set of resources among the agents. The set of resources allocated to a specific agent is also called the bundle assigned to that agent (Chevaleyre et al., 2006). Efficient allocation of resources in grid environment is a complicated task. Plenty of researches have been performed on the resource allocation in grid environment. A few recent works related to this resource allocation in the literature are reviewed in the following section.

Numerous methods have been developed to perform the resource allocation in grid environment. However, major problems still exists in the literay works that are inefficacy in resource allocation based on economic scheduling and resource insufficiency for executing jobs in conventional resource allocation techniques. To avoid this drawback, we propose resource allocation models based on Penalty functions and Evolutionary Algorithms. As practical application of specific methods is restricted by the complexity of practical problems and limitation of heuristic methods as a result we have to select the Evolutionary algorithms. For constructing projects using Evolutionary algo-
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