ENHANCED GRID RESOURCE SELECTION MECHANISM

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Abstract: Resources in grid systems are heterogeneous, geographically distributed, belong to different administrative domains and apply different management policies. To manage resources in grid computing, efficient resource selection mechanism is required. In traditional non-reserved resource selection mechanisms, there is no guarantee that the job completion time will be as expected. On the other hand, in the reserved bidding process, conventional resource selection mechanisms waste providers resources and hence affect the overall grid system performance. We propose a new grid resource selection mechanism to achieve performance enhancement in the resource allocation process.

1 INTRODUCTION

Grid computing emerged in the middle of 1990s as a wide-scale distributed system to offer dynamic coordinated resources sharing and high performance computing (Foster and Kesselman, 2004). Grid technologies have evolved over the past two centuries from primary metacomputing into Open Grid Service Architecture(OGSA) using the service oriented architecture (SOA) Concepts.

Grid computing as defined previously differs with current internet technologies, as the current internet technologies handle the process of exchanging data between internet users, but they do not support methods for coordinated employment of several resources at different internet locations for computation (Iamnitchi and Foster, 2001). CORBA and Enterprise Java as distributed computing technologies differ with grid computing as they allow sharing of resources inside one institute or company but not with other outer institutes or companies (Harold and Loukides, 2000; Iamnitchi and Foster, 2001). In Storage Service Providers(SSP) and Application service Providers(ASP), Institutes are permitted to serve outside clients but this occurs in restricted manners, such as using special types of network connections (Iamnitchi and Foster, 2001). According to the previous review current technologies do not handle all resource categories or do not support the management and flexibility needed to build the coordinated resource sharing among several institutes and organizations.

This paper is organized as follows: Section 2 describes the resource management in grid computing; this is followed, in Section 3, by a discussion of the related works in the area. Details of the proposed mechanism are presented in Section 4; followed by a conclusion and discussion.

2 RESOURCE MANAGEMENT IN GRID COMPUTING

2.1 Overview

Resources in grid systems are heterogeneous, geographically distributed, belong to different administrative domains and apply different management policies (Ahmed et al., 2007; Chang et al., 2011). Furthermore, grid management systems do not have full control over the resources that belong to the grid (Schnizler, 2007). Czajkowski et al. (2002) defined the term resource to denote any capability that may be shared and exploited in a networked environment. The resources and services may differ in the form of functionality that they offer to the user, but both are similar in the way that they provide the functionalities

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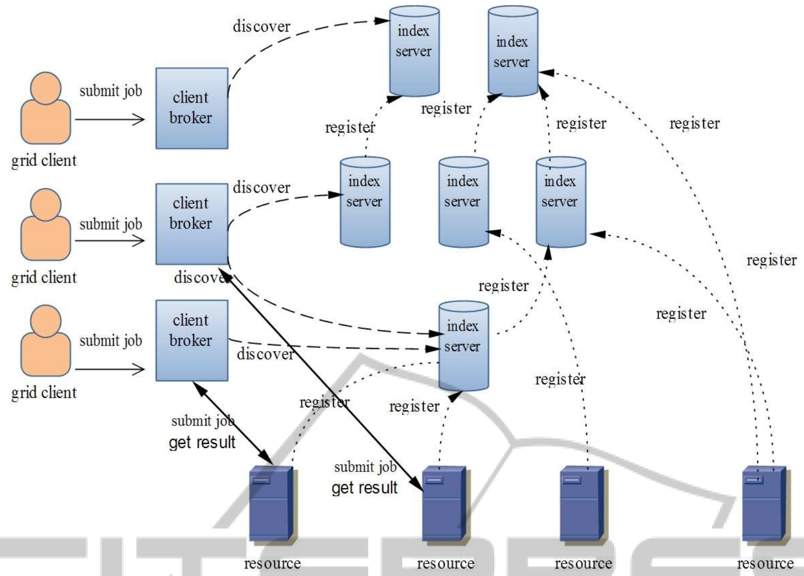

Figure 1: Grid Resource Broker.

to the users (Foster and Kesselman, 2004; Andrieux et al., 2004); hence we can use the term resource more generally to indicate all types of ancient resources, as well as services.

In conventional computing systems, such as PCs, cluster systems and other high performance computing, resource management problem has been studied intensively and a number of different types of management systems are implemented such as batch scheduler, workflow engine and local operating systems. These systems have full control over resources that follow them and also have a full understanding of all information on those resources (Schnizler, 2007). The local recourse management systems are not capable of managing grid computing resources since the heterogeneity of resources and environments in grid networks. Moreover, grid management systems do not have the full control over the resources that they manage (Schnizler, 2007). Resource management in grid environments is a great challenge; this is due to the heterogeneity of resources in grid environments and besides that, the resources belong to diverse administrative domains and apply different management policies (Wang et al., 2010).

2.2 Resource Brokers

In the decentralized resource broker systems, each grid user has its own broker to access the available grid resources. All resources that participate in the grid system must register in one or more index servers. However, these index servers have the ability to register in other index servers. The discovery of available grid resources is made by the user's resource brokers through communicating between client broker with one or multiple index servers and the result of this process is a list of all available resources that satisfied the user needs. If the resource broker needs more information, it can contact the resource provider directly. Before the submission of the user jobs, the user broker select suitable resources from the available resources depending on some selection criteria such as the Quality of service (QoS) requested by the user, and locations and policies of the resource providers (Krauter et al., 2002; Elmroth and Tordsson, 2008). Figure 1 describes decentralized resource broker process.

2.3 Co-allocation and Advance Reservation

In some scenarios grid clients request more than one resource at the same time to perform a specific task, part of those resources is meaningless to the client. Accordingly, the resource allocation system should find a way to provide those resources all together as a bundle. The process for requesting a number of homogeneous resources concurrently by the grid clients is called Co-Allocation; therefore, the allocation manager should support a co-allocation mechanism (Schnizler, 2007; Elmroth and Tordsson, 2009).

Advance reservation is an important issue arise when grid clients request grid resources at a certain time in future; for instance, a grid client demands processor after two hours, and in some cases the grid client needs resources for a certain period of time

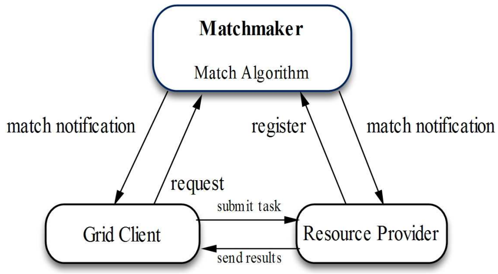

Figure 2: Matchmaking Approach.

in the future, such as a client requested memory after two hours and for one hour. Some grid clients need resources in a time in the future, but the time is not well-defined; for instance, a grid client needs resources after two or three hours. Therefore, the allocation management system must comprise a way for the grid clients to describe the time in which they need the resources precisely; and this may also help the resource providers to clarify at which times their resources will be idle in the future (Elmroth and Tordsson, 2008, 2009) .

3 RELATED WORK

Due to the heterogeneity of grid resources, there is a need to describe those resources in a standard way so that providers and grid clients can allocate them in consistent way (Park and Kang, 2007; Yuesheng et al., 2009). There are two types of resource selection approaches for grid environments, matchmaking approach and bidding based approach. In matchmaking approach (Figure 2) resource providers describe and register their resources in the matchmaker database. When a grid client requests resources to perform tasks, it determines the properties of those resources to the matchmaker (Yuesheng et al., 2009); and the matchmaker will perform a matching algorithm to match the resources to tasks and sends notification to the grid client and to the selected resource provider (Wang et al., 2010). The resource providers update their resources states to the matchmaker periodically and any changes occur between the updating processes is not reflected in the matchmaker. Moreover, the matchmaker like other centralized systems represents a performance bottleneck and single point of failure (Wang et al., 2010).

The idea behind bidding based approach arose to avoid the matchmaking drawbacks. In the bidding process when a grid client needs resources to execute certain jobs, it forwards a call for proposal CFP message to grid providers (Hongbo et al., 2005; Wang et al., 2010). Upon receiving the CFP messages, resource providers decide whether or not to join the bidding process according to their facilities and resources characteristics. If a grid provider participated in a bidding process it dispatches a bid to the client. The client assesses all the received bids and chooses the best bid according to a specific bidding algorithm (Habibi and Jafar, 2009; Vilajosana, 2008; Wang et al., 2010).
Resource securing in grid resource allocation process can be achieved in two different ways; In reserved securing and non-reserved resource securing (Wang et al., 2010). In reserved method the resource providers keep the resources for the grid client's bids; so it can guarantee the future status of the resources (Haji et al., 2006). However, this method wastes resources because more than one resource provider may keep their resources for a single bid and at the end the grid client will select only one resource and reject the others; and so those rejected resources are wasted at the time that they have been kept for that client's bid (Wang et al., 2010).

On the other hand, in non-reserved resource securing method the resource providers do not keep the resources for any bid; and hence the resource providers can utilize their resources effectively; nevertheless, this method does not promise the future status for the resources; and hence there is no guarantee that the job completion time will be as expected (Haji et al., 2005; Yousif et al., 2011).

4 THE PROPOSED MECHANISM

We propose a grid resource selection technique to tackle the problems of conventional reserved and non reserved bidding approaches; following is a brief description of our mechanism. In our mechanism when a grid client requests resources, it create a call-for-proposal CFP messages and forwards it to all available resource providers in the grid system and wait for a certain time interval for bids. Upon receiving the CFP messages, resource providers decide whether or not to join the bidding process according to their facilities and the resource's characteristics. If a resource provider participated in a bidding process it dispatches a bid to the client and reserves the corresponding resources for that bid. The bids arrive at the grid client one by one; and the clients have to assess the received bids and make judgments immediately. At the beginning the first bid arrives at the grid client is considered as the best bid; and when the next bid arrives at the client, the client compares the current received bid with the best bid, if the current received bid is better than the best bid the client will consider the current received bid as the best bid and notifies the first resource provider that its bid is rejected and then the provider will free the resources. However, if the old best bid is better than the current received bid the grid client simply sends reject notification message to the new provider to free its resources.

5 CONCLUSIONS

This paper presents a new resource selection mechanism in a bidding based grid system to enhance the process of resource selection in an effective and efficient way. The proposed mechanism tackles the problems arise when using traditional reserved and non-reserved resource selection mechanisms. Our algorithm keeps the most suitable resource for executing the job as a promise, and therefore, the job completion time will be as estimated. Furthermore, since the proposed mechanism reserves only one resource, resource providers can utilize their resources effectively. Now we are in the implementation phase, and we plan to simulate the mechanism in a grid simulated environment using GridSim as a simulator, to evaluate the performance of the proposed mechanism.

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