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A Reliable Resource Allocation Approach for Grid

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ABSTRACT

Grid Computing is a group of clusters connected over high-speed networks that involves coordinating and sharing computational power data storage and network resources operating across dynamic and geographically dispersed locations. In a desktop grid model, the job is submitted for execution only when the resource is idle. There is no guarantee the job started to execute will complete its execution without any distruption. This paper describes a secure resource allocation model, which allocates the resources to authenticated grid users. We improve the functionality of the system by submitting the jobs on machines that have a higher probability of being available at a given time.

1.0 Introduction

A grid enables the construction of a virtual computing system that interconnects geographically distributed computing systems with a variety of resources. Here resource refer not only to physical computers, networks and storage systems but also to much broader entities such as databases and data transfer. Grid computing is a collection of autonomous and distributed resources available over the virtual organization, and collaborative works with effective ,efficient and reliable way[2].Volunteer computing systems often use a master-worker style of computing where tasks are distributed from a master machine to worker machines .The tasks are stored in servers and are sent to clients for execution. The task is referred to as a job [1].Grid computing provides highly scalable, highly secure and extremely high performance mechanisms for discovering and negotiating access to remote computing resources. This makes it possible for the sharing of computer resources among an infinite number of geographically distributed groups. There are several contributing factors that make it difficult to guarantee availability of computing resources:(i) resources are donated but not necessarily dedicated, meaning that the resources that are available for use change dynamically over time;(ii) since donated resources are not dedicated it is possible for the resource owner to initiate activity that may disrupt the job using the resource.

Task scheduling is a vital and challenging task in grid computing. Once the tasks are available, the broker interacts with Grid Information Service (GIS) to identify the contact information of resources and then interacts with resources to determine their dynamic information, including availability and configuration. Scheduling jobs to resources in grid computing is complicated due to the distributed and heterogeneous nature of the resources. Stagnation in grid computing system may occur when all jobs require the same assigned resources. This will lead to resources having high workload and stagnation may occur if computational times of the processed jobs are high. In grid computing system, resources are not under the central control and can enter and leave the grid environment at any time.

An effective grid resource management with good job and resource scheduling algorithm is needed to manage the grid computing system. The algorithm must consider the dynamic changes in grid environment because the computational performance changes from time to time, networks connections may become unreliable, resources may join or leave the system at any time and resources may become unavailable without any notifications. In grid computing environment, there exists more than one resource to process jobs. One of the main challenges is to find the best or optimal resources to process a particular job in term of minimizing the job computational time. Optimal resources refer to resources having high CPU speeds and large memory spaces. Computational time is a measure of how long that resource takes to complete the job. An effective job scheduling algorithm is needed to avoid or reduce the stagnation problem. Grid level resource scheduling with job grouping strategy that maximizes the resource utilization and minimizes processing time of jobs. Grid Information Service contains the components like resource table and grid monitor. It sends the status about the grid system to the grid scheduler In a Grid computing environment, scheduler is responsible for selecting the suitable machines or computing resources for processing jobs to achieve high system throughput, but there exist several applications with a large number of lightweight jobs. Job scheduling with light weight jobs gives low performance in terms of processing time and communication time. So to achieve high performance, jobs are scheduled in groups incase of light weight jobs.

A Grid is a decentralized, geographically distributed and heterogeneous system in which resources belong to individuals or multiple organizations. Resource management and job scheduling are two the important and difficult tasks in grid computing. Scheduling and execution of jobs in a dynamic environment like Grid often calls for efficient algorithms to schedule the resources required for successful execution of the jobs. These dynamic and heterogeneous resources may enter or leave the system at any point of time or fail and can be idle. So an efficient scheduling strategy is required to minimize the total processing time of jobs and also to adapt heterogeneity and the dynamism of the environment with maximum resource utilization. In a Grid environment, there are two levels of resource allocation, one for Grid schedulers and the other for local resource schedulers. The two schedulers are different in functionalities . Grid scheduler searches resources over multiple remote sites, and allocates the job to one of them, while a local resource scheduler actually manages the local resources and does actual execution according to its local policy. In general local resources are unlikely to surrender ownership or full control to other parties, Grid scheduler can only make its best effort to select a resource. It is difficult to provide any assurance that a job is given a guaranteed quality of service level.

The paper is organized as follows. Section 2 describes the related work, Section 3 presents the architecture, Section 4 describes the implementation details and Section 5 gives conclusion and future work and lastly, the references.

2.0 Related Work

Resource management and job scheduling are two most important and difficult issues in grid computing. Selection of the appropriate resources among the available resources is significant as it determines whether a job is going to be executed in a client machine without interruption, associated reliability ratings to clients, based on number of jobs successfully executed in the past. Depending on the reliability rankings the resources are then selected for job execution.

Cloud Home and Nebulas proposed the usage of distributed voluntary resources in cloud computing. Our system architecture addresses many of the challenges laid out in or can be extended to address the challenges. Grid level resource scheduling with job grouping strategy that maximizes the resource utilization and minimizes processing time of jobs. Grid Information Service contains the components like resource table and grid monitor. Computational grids are evolving that comprises of heterogeneous collection of resources. Owners apply different policies for making machines available, some will be completely dedicated to grid, others may only be donated when they would otherwise be idle and other policies will reside between these extremes.

Web service grid resource management is a system which provides an easy way to manage distributed computational resources and an efficient way to process a large number of user requests for computing, In the Grid Web-based Operating system environment, upon receiving a grid job request via Web Browser, the system provide the light weight approach for acquiring grid services via grid widgets, which in turn connect to the Resource Information Provider, Resource Broker, Data Control and File Manage to provide integrated services to the users.

Kondo characterized resource availability in enterprise desktop grids and identified three types of availability: host availability, CPU availability and task execution availability. Previous work on desktop grid resource availability prediction considers only these types of availability in their models. The prediction model proposed in this paper also considers the behavior of other peers in the system. As participants in a P2P desktop grid can be either provider or consumer, and the resources are distributed based on an incentive mechanism, the consuming peers' demand and the donating peers' offer will affect the availability of resources for the peers. The prediction model proposed in this paper also considers the demand of other consuming peers on the system and how the resources are allocated according to the incentive mechanism of the P2P desktop grid.

3.0 Architecture

This section presents the overall architecture of our system. It has the following components such as Clients, Grid service layer, service delegates and database handler.

A. *Client*

A client that needs resources to run its tasks makes the request through the job service. The client that needs to access the resources of the grid must have the ClientID. Registration is verified using ClientID. If any new user arrives, registration is completed first and then the new grid client ID is assigned. Grid resources are only accessible to the users having the ClientID. The Registration service is mainly used to generate client ID for the users and the client information is stored in the database.

B. Grid Service Layer

The Grid service layer is the core layer which contains all the services in the grid. The services will get invoked to respond to user requests accordingly. The services provided by the layer are explained below.

1) ***Job Service:*** Information about every job is stored in the job service. A job service does not maintain information about the resources. The authentication service checks whether the requesting client is the authorized client. Unauthorized users are not allowed to access the grid.

2) ***Client List Service:*** This service is mainly used to list all the clients that have registered to participate in the grid service activities. The Client List Service can only be viewed by the administrator to know the number of clients utilizing the services.

3) ***Job Execution Service:*** A client that needs resources to run its tasks makes the request through the job server. When the client requests the job service for the job to be executed, the job service sends the request to the authentication service to check whether the client is authorized or not. If it is the authorized client the process requests the resource prediction service for the resource needed to execute the tasks. The resource prediction service is used to allocate the requested resource to the client for executing the job.

4) ***Authentication Service:*** Registration is verified using clientID.Grid resources are accessible to the users having clientID.Authentication should be verified for the grid resource owners as well as resource requesters before they are allowed to join in grid activities. Unauthorized users are not allowed to access the grid. Security is ensured through the authentication service.

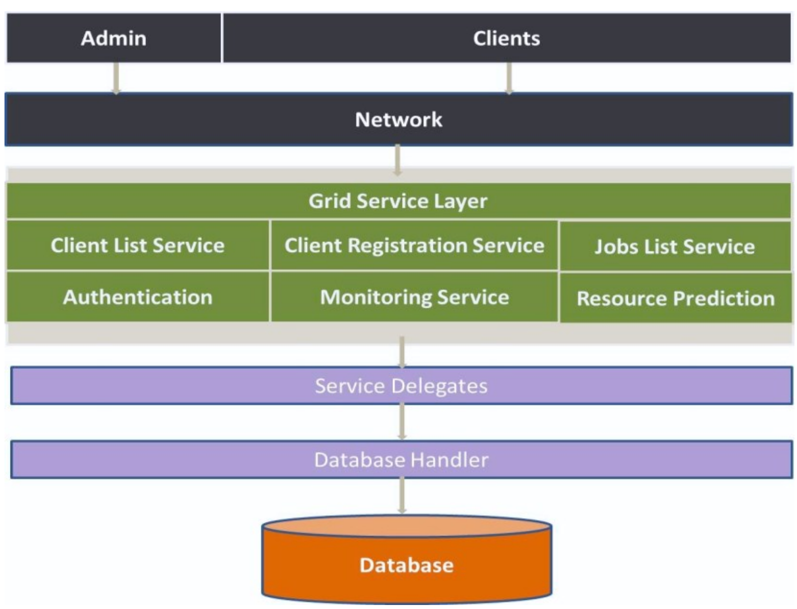

Fig 1: System Architecture

5) ***Resource Prediction Service:*** Once the job request is raised by the client, the job service identifies the job and sends the resource request to the resource prediction module. The resource prediction service checks for the availability of the resource in the database. If the resource is available the resource is allocated *for* the particular job for execution and locks the resource. Once the resource is locked it can't be used by other clients. After the execution is completed the resource is unlocked so that the job execution by other clients requesting the same resource can make use of the resource.

6) ***Monitoring Service:*** The monitoring service is mainly used to monitor the status of the job being executed. This is mainly used to displays all the jobs that are executed and their results. Once the user requests the monitoring service, it searches the database and displays the history of the job table.

C. *Service Delegates*

The Grid service layer is the core layer which contains all the services in the grid. The services in will get invoked to respond to user requests accordingly. Service delegates acts as an interface between grid service layer and database handler. It contains all the services used by the modules internally.

D. *Database Handler*

The delegates comprises of any logic to convert the request parameters to the Database handler required format. Database handler uses the objects given by the delegates and interacts with the database. The handler contains all the DAO(Data Access Objects) required for the database interaction.

4.0 Implementation Details

The services of this system are hosted on an Apache Maven Webserver. Functionality is exposed as web services. The Web Services are implemented as CXF web services. Boss Server is used as an application server to deploy all the services used in the grid service layer. The Client has been developed using Java Spring framework. My SQL is used for database access. Eclipse is used to develop the WSDL (Web Service Description Language) framework for the entire system activity.

5.0Conclusion and Future Work

In order to achieve secure resource and job scheduling including minimum processing time and maximum resource utilization, A secure resource and job scheduling with job grouping strategy in grid computing has been proposed. Previous work in resource allocation method which was done in the client server environment was not secure and all the users can access the grid without knowing the use of accessing the grid. Here we introduced the system such that the number of jobs is fewer than the total number of resources. Scheduling in a large scale grid that comprises a heterogeneous collection of resources requires techniques for dealing with resource failure and unavailability. Checkpointing and replication are two primary tools that the grids use to mitigate the effect of this resource volatility. This model provide real grid computing environment and reduces the processing time of the jobs

Future work includes improving prediction by using more advanced prediction and learning models. Prediction would also be improved by improving the grouping of non-dedicated desktops. Future work would look into automatic clustering techniques based on similar usage patterns. In future the work can be extended to design a parallel grid scheduler to realize its performance.

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