Analysis of Advanced Grid Resource Management Models

Navjeet Kaur[1], Harpal Kaur[2], Er. Satinder Pal Ahuja[3]
[1]*M.Tech. (CSE), Student,* [2]*Asstt. Prof (CSE),* [3]*Associate Professor & HOD (CSE&IT),*
Indo Global College of Engineering
kaur_6aug@yahoo.in, er_dhaliwal_er@yahoo.co.in, asatinderpal@gmail.com

Abstract: *Grid computing which allows thousands of people to collaborate at the same time and to share resources for running their application suffer mainly from administration of grid resources. This review paper will cover recent addition of Grid resource management models which are derived from three basic models. The paper is divided into five sections where the first section is the brief introduction of grid computing and its major issue, second section covers basic and recent resource management models. Third section discusses workflow of various modern grid resource management models in details and fourth sections contains summary table which is completely based upon the theoretical study of the models. Finally, we end up the paper with general conclusion and our future work in the field.*

Keywords: *Grid, Grid Computing, Grid Resources, Grid Resource Management Models.*

1. Grid Computing and its Major Issue

The goal of grid computing is to create the illusion of a simple yet large and powerful self managing virtual computer out of large collection of connected heterogeneous system sharing various combinations of resources. It harnesses a diverse number of machines and other resources to rapid processes to solve problem beyond an organization's available capacity.

One of the biggest issues in grid computing is the management of resources means how to calendar users' tasks onto numerous grid resources to complete some performance goals, such as minimizing execution time, minimizing communication delays, maximizing resource utilization and load balancing. This requirement of distribution becomes a resource management problem, which is the

process of identifying requirements, matching resources to applications, allocating those resources, and scheduling and monitoring grid resources over time in order to run grid applications as resourcefully as possible.

In the next two sections, we discuss some of the basic and derived resource management models.

2 Basic & Advanced Resource Management Models

Three basic resource management Models [1] are as follows:

- Hierarchical Resource Management Model
- Abstract Owner Model
- Economy/Market Model

All the models which we are going to discuss in the third section are derived from these basic models. Table 1 illustrates the working criteria of these three resource management model.

MODEL	REMARKS
Hierarchical	It captures architecture model followed in most contemporary systems.
Abstract Owner	It follows an order and delivery model for resource sharing, which for the most part, ignores existing infrastructure in order to focus on long-term goals.
Economy/Market	It follows economic model in resource discovery and scheduling that can co-exist or work with contemporary systems and captures the essence of both hierarchical and abstract owner models.

***Table 1**: Basic Grid Resource Management Model [1]*

The next section covers workflow structure of various new models which are

- Integrated Resource Management model
- Multi-workload Sharing Oriented model
- Agreement based resource management model
- WS- management resource management model
- Novel agent based dynamic grid resource management model

3 Workflow Structures of Advanced Resource Management Models:

A) Integrated Resource Management Model

This model is the based upon both hierarchical and economy model [2]. Major component taken into consideration in this model which is not illustrated in any

previous model is the "Security Check". So clearly this model is good in system where security is of major consideration. The basic workflow diagram is shown in figure 1 below.

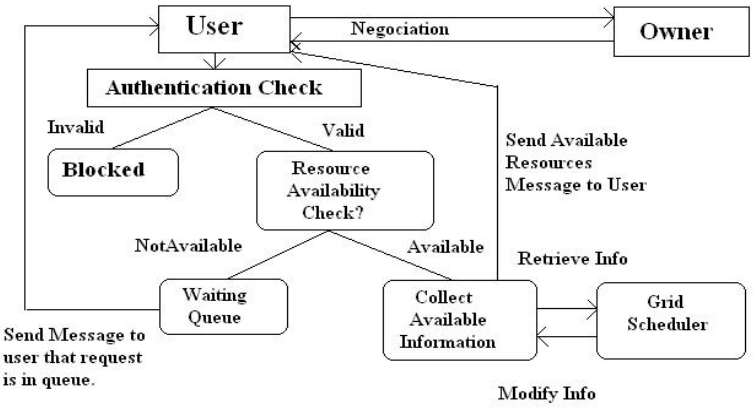

***Figure 1**: Workflow diagram of Integrated Model*

B) Multi-workload Sharing Oriented Resource Management Model

This model is based upon hierarchical model. The model is divided into various layers which provide a clean layer structure which is easy to understand and implement [3]. The major add on feature in this model is "Sharing workload at every level". Every responsibility is beautifully shared between layers. The basic workflow is shown in the figure 2 below.

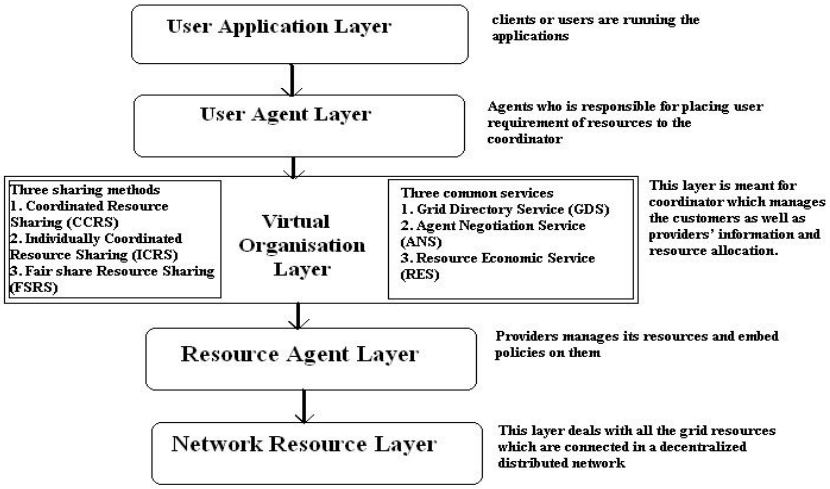

***Figure 2**: Workflow diagram of Multi-workload Model*

C) Agreement Based Resource Management

The model taken into consideration two important aspects which are

- Assurances concerning the level and type of service being provided by the resource.
- Owner control over how the resource can be used and how much service information is exposed to the consumer of the resource.

The solution provided by the model is to negotiate an agreement (sometimes called a Service Level Agreement, or SLA), by which a resource provider "contracts" with a client to provide some measurable capability [4]. The model is based upon Abstract Owner model and major consideration is on "Client-Owner Communication" The workflow of the model is shown in figure 3 below:

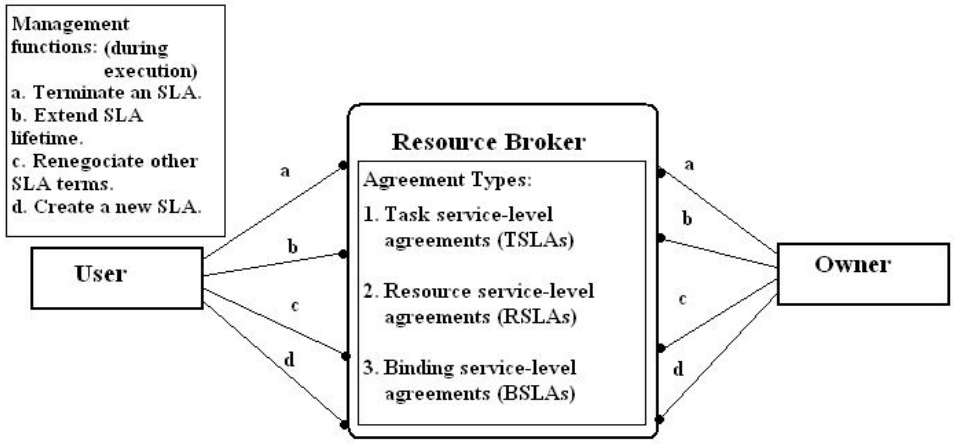

***Figure 3**: Workflow diagram of Agreement based model*

D) WS-Management based system and network resource management middleware model

The model is based on web-services (or WS) management protocol which provide high cohesion between components and make the network of grid computing robust and more independent [5]. The main component of this is management server, gateway server and resource broker. Resources are directly providing manageability interface through the management server. The main

responsibility of gateway server is updating the resource broker as well as management server with the manageability interfaces information. Management server requests the information in service broker to find all the managed IT resources' WS-Management interfaces and then accesses these manageable resources directly or through gateway [5]. The workflow of the model is given in figure 4 below:

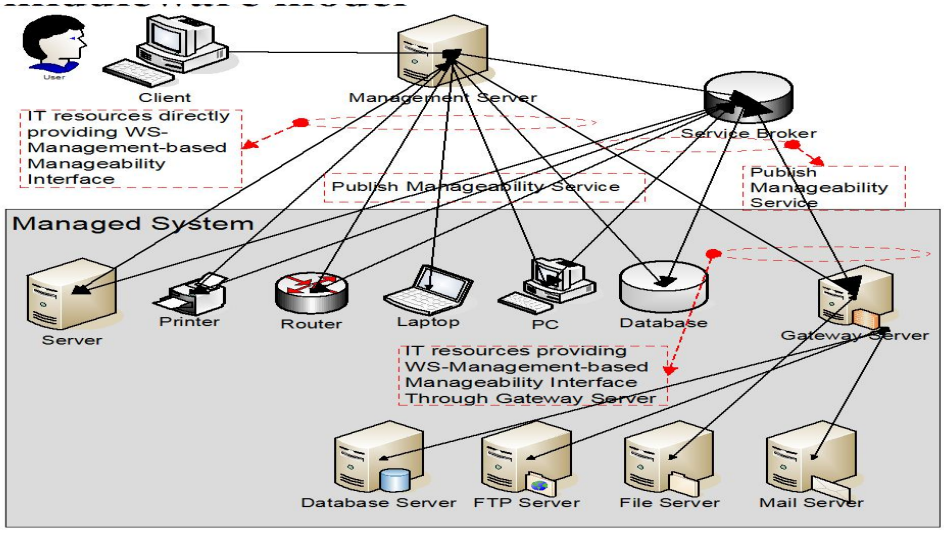

***Figure 4**:*
Workflow diagram of WS-Management Model [5].

E) Novel- Agent Based Dynamic Grid Resource Management System

The proposed model is logically constructed as a hierarchical two-layered Heap Sort Tree (HST), so as to make balanced and effective job scheduling for the grid computing system. In our model, every nodes of the grid computing system has two kinds of agents deployed on it. The two kinds of agents are [6]:

- Autonomy Representation Agent (ARA).
- Node State Monitoring Agent (NSMA).

These both are generally called Grid Resource Management Agents (GRMA). Agents are allocated according to their computation work required.

The workflow diagram is shown in figure 5 below:

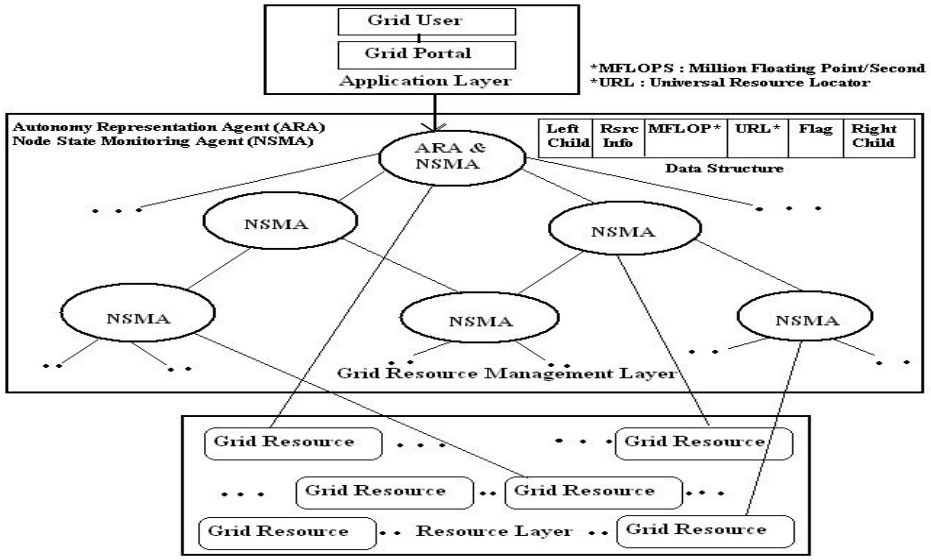

Figure 5:
Novel Agent Based Dynamic Model

ARA is used to represent the very node selected out from the autonomy, whose current available computational ability is the largest among all nodes of the autonomy. On the other hand, NSMA is used to represent various kinds of hybrid computational resources of the grids, and it should always be activated to monitor the node's dynamic available commuting power so as to cooperatively construct the HST for the autonomy [6].

4 Summary

Model	Derived from	Add-on Feature	Advantages	Disadvantages
Integrated Grid Resource management model	Hierarchical and economy model	Security Check	• Secure communication. • High priority jobs are executed first. • User can easily get required readings through display window. • Owner keeps the record of clients which build Trust level for specific context.	• User has to wait until the resources are available. • No Specification is given for level of service utilization for resources
Multi-Workload Grid Resource Management Model	Hierarchical Model	Equal Load distribution on every layer	• Provide a tuneful and clear approach. • Reliable resource services. • Ideal model for large distributed network. • Sharing options available to user.	• Performance parameters for the job completion are not considered. • No priority for time critical problems or problem with real time constraints.
Agreement based grid resource management model	Abstract Owner Model	Various Service Level Agreements	• The provider (or consumer) will publish whatever policy information it wishes to make available to potential consumers for the purposes of service discovery and can also make policy private to itself.	• Increasing overhead by making separate policy decisions to make regarding what consumers are allowed and what application managers are allowed.

			• Access Privileges provide better security to resource management. • Sequence of agreements with increasing levels of commitments lead to more robust resource management solution.	• A distributed commitment protocol can cause problems when the agreement contains terms that have real-time constraints.
WS-Management Grid Model	Economy model	Use of open standard protocol	• The protocol used is standard and open. • Work load is equally distributed among major components.	• Specific system requirements for WS-Management given in [5] which sometimes hard to achieve.
Novel Agent based dynamic grid resource management Protocol	Hierarchical and Abstract Owner Model	Take advantages Heap sort tree principal and Use of intelligent agents.	• Two-layered Heap Sort Tree (HST) makes the grid system more scalable and Robust. • By taking advantages of agents in constructing and reconstructing the two-layered HST, this model is well fitted with the unpredictable changing grid environment [6]. • High Performance and fault-tolerance.	• Overhead of implementation and maintenance. • Congestion is often in network.

***Table 2**: Summary of Some Recent Grid Resource Management Model*

5 Conclusion and Future Work

In this paper, we discuss various models and their workflow patterns but no model till now is the optimal one which is suitable for all dynamic conditions of grid environment. Also, there is no clear distinguishing that model suitable in which conditions. All the models have number of advantages but on the other side of coin suffer from drawbacks too. Our future work will focus on distinguishing these models on various practical parameters like scalability, reliability, delay etc.

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