# Research on Balanced Scheduling of Useful Information Resources in Grid Space

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***Abstract:*** With the rapid development of network technology, a large number of information resources are heterogeneous, and the useful resources in grid space have the defects of low resource utilization rate and network load imbalance. The resource scheduling algorithm establishes the information resource model, organizes the resources reasonably, locates the useful resources quickly, improves the effective utilization of grid spatial resources, and makes the grid spatial node load balance.

***Keywords:*** Grid Technology; Information Resource Management Model; Resource Location

## 1. Research Background

In recent years, the powerful computing power of supercomputers and servers is widely used. The high bandwidth and high speed network has been applied in the wide area environment, and the function of personal computers is becoming more and more powerful. Grid is a group of emerging technologies built on the platform of Internet. It integrates high-speed Internet, remote equipment, computers, sensors, large databases and so on, and provides more functions, services and resources for ordinary people and scientific and technological personnel. However, in the grid environment, the system resources are dynamic and heterogeneous, and the communication latency is highly uncertain. It is not only necessary to support cross-organization or management domain task scheduling, real-time monitoring of resources and job execution status, but also to maintain local site autonomy and provide corresponding support. To establish a dynamic resource management system model adapted to complex environment, effective use of space resources, load balancing.

## 2. Information resource management model

Under the powerful computing function and sharing technology, there are a variety of resources for us to use, such as computing resources, storage resources, software resources, hardware resources and so on. How to manage many kinds of resources, which method is feasible in many management methods, management efficiency is significantly improved. We take the following entry point as the goal of our research.

(1) Abstract resources and provide interfaces for resource access. The logical abstraction of resources on the grid, such as providing a reasonable description of resources, can provide a convenient channel for the location and discovery of resources in the subsequent resource management, so as to improve the search speed.

(2) Coordinate resource sharing. According to the characteristics of the resource itself and the resource owner, the sharing policy is formulated, such as time slice rotation policy, first come first serve policy, etc. Not only requests from one resource requester requesting multiple resources, but also situations where a resource is requested by multiple resource requesters should be supported.

The resource manager also needs to use resources on behalf of requesters and establish safe resource usage mechanisms. In a traditional system, a user needs to create an account on the resource and use the resource through that account. But under the grid system, a large number of users and a large number of resources cannot achieve this. If the resource manager is a superuser of a grid, the superuser can work on the resource instead of the grid user. When the user requests, the resource manager establishes a location-user resource pool for the user to conduct activities locally on the resource. The user resource pool is established dynamically. It is created when it is used and revoked when the request is complete. Therefore, the number of user resource pools that exist on a resource at the same time is small, and the management will not cause a great burden.

Grid resource management is very important in grid computing system. These include job management, task scheduling, and resource management. That is, users submit jobs to the grid system through the job management function, specify the required resources for jobs, delete jobs and monitor the running status of jobs. The job submitted by the user was arranged by the task scheduling function according to the type of each task contained in the job, the required resources, available resources and so on. The resource management function determines and monitors the grid resource status, and collects information such as resource occupancy when jobs are running. Its internal structure can be divided into four layers: user layer, grid security layer, resource management layer, resource layer. The user layer mainly provides interfaces for users to support the creation, submission, control and scheduling of jobs. The grid security layer is mainly responsible for user identity authentication, such as determining whether the user has the right to use the grid, whether the user's name and password are correct, etc. The grid management layer is the core part of the whole resource management system, which is responsible for the interaction between users and resources, resource location, resource matching, resource scheduling, resource monitoring and other operations. The resource layer is the provider of resources.

# 3. Discovery of network heterogeneous resources

Resource discovery machine is in the grid environment. It needs a new mechanism to make the grid get what it needs from a large number of resources, and make the resources that need to work together discover each other. It should not only consider the location information of resources, but also further consider the semantic information such as the attribute of resources. Resource discovery is the process of finding suitable resources for a requester from the grid according to the requester's resource request description. Resource discovery can be formally described as a function:

$$S = f(q)$$

The input variable to this function is the resource requirement and the output variable is a unique identifier for a resource. The function f is the representation of the resource discovery.

There are different definitions of resource discovery, the relevant ones are as follows:

Definition 1.1: For A resource description set D and A resource attribute set A, if $\forall d_i \in D$, $\exists a_j \in A$, such that $a_j$ contains $d_i$, then resource A is said to satisfy request D, denoted as S(A,D).

Definition 1.1 is not strict in the sense that there is no precise definition of "inclusion" in.

Definition 1.2: For A grid G, let d be any resource description set. If there exists A process P and A resource set A such that P(d) = A, where $\forall a_i \in A$, $S(a_i,d) \wedge a_i \in G$, then the process P is called a resource discovery process in the grid G, and A is called the goal set of P to d.

Definition 1.2 only illustrates the functionality of the resource discovery process and does not give a more exhaustive description of the resource discovery mechanism itself.

Although it is difficult to give a specific definition, a relatively complete resource discovery mechanism in grid environment should generally answer the following four questions:

• Membership protocol: It specifies how resources or nodes join the grid, how to obtain information about other nodes or resources, and how to communicate with them.

• Overlay construction: how a grid node can select a subset of active nodes from other grid nodes that are locally visible to it, so that the necessary resource information can be obtained by interacting with the nodes in this subset. In this way, from the global view of the grid, only part of the edges are selected to form a cover in the graph composed of grid nodes, and the resource information of the whole grid can be obtained at any node.

• Preprocessing: Measures taken in advance to achieve better search performance. These measures are independent of the resource request. Preprocessing can be the reconstruction of network coverage, such as reconstructing the coverage of node graph by the coverage construction function in real time according to the distribution of requests and resources.

• Request processing: it consists of local processing and remote processing:

(1) Local processing includes matching requests in locally stored information and processing requests according to specific policies, such as dropping requests whose lifetime exceeds the TTL limit, or rejecting requests from certain nodes according to management rules.

Remote processing refers to the rules of request forwarding: requests are sent to other nodes according to different policies (e.g, shortest distance first).

# 4. Organization and registration

Make good use of these useful resources in the grid environment, it is necessary to organize these resources reasonably. We can use a way of saving money with customers in the bank to register (store) resources in the local resource manager. In fact, each resource manager is equivalent to a search engine. The resource manager accepts the resource request and confirms the existence of the resource based on the IP or URL of the resource (in order to prevent the submission of nonexistent resources). And further verify the attribute information of the resource and collect some information that the user has not considered, such as the bandwidth of the network where the resource is located, the performance, and the time required to access the resource. After confirming the category and other main attribute information of resources, the resource manager records these information into the corresponding position in the information table according to the category of resources, and extracts some key information, such as CPU frequency, memory capacity and operating system, etc., to establish an inverted index. If a large number of resources are searched, the set of resources that meet the conditions can be searched according to keywords. So this resource belongs to at least one category and must have a description of the corresponding attribute information. This information determines the position of the registered resource in the resource directory tree and the basis for retrieving the resource or even locating the resource.

The resource manager running on each node needs to deal with resource information storage, provide resource processing capabilities to the scheduling subsystem, provide system data to the monitoring subsystem and accept commands from the monitoring subsystem, and deal with dynamic changes of resources.

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