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Abstract. The technology of task assignment in Grid Internet System is one of pivotal technologies. In this paper, based on researching the essential conditions of realizing intelligent schedule measure, then a novel intelligent schedule measure is designed in, besides analyzing the advantages of this new schedule measure, the concrete realizing proceeding of it is discussed too .

1. Introduction

The Grid computing can be regarded as an one branches of advanced computing sciences and technologies, it can not only integrate the different resources of computing with different positional distribution, but also can integrate and link different equipment types computers together. In recent decades, there are some research achievements of the Grid Computing theories and technologies [1-4] but up to now, it is in the primary stage of the research and application, it is a long distance between the real universality and practicality of grid network. There are lot of problems such as computing resource management, network and system monitor, system mutual-operation, software compatibility, system communication, system security, system robustness, intelligent schedule measure to be researched and solved, in this new field, the creative methods that are different from the traditional methods of network sciences and technologies are eagerly to be studied.

The technologies of schedule measure in the Grid Network are pivotal technologies of the whole system, though they have developed from the traditional schedule measure methods in distribution and parallel proceeding, they appear the common characters of parallel and distribution proceeding systems [5-7], the schedule measure methods of the Grid Computing Network appear the distinct individual characters because the grid network system has the particular constructs and functions. The technologies of schedule measure can avoid the non-essential loss, enhance the system operative velocity, and increase the utilization ratio of the resources, they also do pivotal roles of enhancing the reliability and validity of the Grid Computing Network, besides the above, the technologies of schedule measure can directly demonstrate the agility and active characters of the Grid Computing System.

In this paper, based on analyzing and summarizing the essential conditions of realizing intelligent schedule measure, a novel and feasible intelligent schedule measure scheme is pointed out, the main idea of this new method is to define an intelligent comprehensive cost function that can dynamically reflect the tasks allocation to the network nodes which are the processors to realize computing functions under the given conditions and environment of the Grid Computing Network, when the solution of the comprehensive cost function tends to the minimum, then the validity of task allocation can tend to the highest, this new scheme method also can self-adapt to the heterogeneous environment, so the agility and advanced characters of it is obvious.

2. The Conditions Analysis Of Realizing The Intelligent Schedule Measures

The Intelligent schedule method must demonstrate enough dynamical and agile, then it can make the resource deployments match to the computational target requirements, the 'match' means that the scale and performance of the virtual computing platform of the Grid Computing are adaptive to the concrete computational requirement of the network users, it consists of two layers concrete meaning, one is to avoid wasting resources which the virtual computing platform provides, another is also to avoid the statement that the Grid Computing system can not implement the concrete computational requirements because the scale of them are too small. The intelligent schedule measure is one of the technologies and applications in the middle layer of the network system, it is supported by many protocols with the basic layer of the whole network system, it also accepts the support of the constructs of the system and other important technologies, the support conditions of the intelligent schedule measure in Grid Computing System can be summarized as follows.

One support condition is the strongly parallel computing with the distributed network constructs of the network system. the technologies of parallel computing and distributed computing[8] can support the valuable cooperation of the different computers and processors which are with different types, different geometrical positions and different properties ,then the different computing resources can be integrated and unified to be a virtual computing platform which provides a great strong computer power. Furthermore, the intelligent schedule measure can be realized and it's function can be brought into play.

Another support condition is the open corpus characters, cooperative power and security, they are the necessary conditions to make the intelligent schedule measure successful realize as possible. In the new Pervasive/Grid architecture, the architecture and function must be enough open, so the open corpus character of the network system becomes to be an essential condition. The network nodes with highly cooperative power are the basic guarantees to make the intelligent schedule measure, they are also the guarantees to easily add additive services and additive business, The confidentiality and security become the support conditions to make the Grid Computing Network smoothly run, furthermore, because information transmission is an essential function of the Grid Computing Network system, they also need the support of the security and confidentiality of the whole network.

Further, the third support condition is the powerful network mutually-linkage, the nodes of the Grid Network should express strongly agile and active under the hyper-construct environments, because the constructs and systems of different computing resources in different local networks are different and hyper-constructs, to unify these different computing resources as a virtual super-power computing platform or high performance computer system, one prerequisite is that the different nodes of the different types, positions and properties have grand mutually linkage powers, nodes with grand mutual linkage powers must include some special functions which consist of high terminal servers, data books and some kinds of terminal equipment with computing functions, besides them, they also consist of communicational protocols, routes and so on, then the nodes with grand mutual linkage powers can be created to integrate and unify a grand-scale Grid Computing platform or high performance computer system with great scale programs and software system that can adapt to the virtual system, during this proceeding, the nodes are entrusted some self-authorities, such as check and correction wrong codes, security and computational confidentiality, which supports to realize the intelligent schedule measure.

In addition, the theories, technologies and applications of the Grid Computing Network are rapidly developing, some novel technologies and conditions will become new support conditions of realizing the intelligent schedule measure.

3. An Intelligent Schedule Measure Scheme

The schedule measure of the Grid Computing Network system is a non-determined dynamical allocation method in the heterogeneous environments, the intelligent schedule measure is an optimal scheme to make the best property indices of the whole system, those property indices include the best of the resource utilization ratio, the shortest treating and proceeding time, the optimal reliability, availability, security, confidentiality and robustness of the whole network system, and so on. so the proceeding of devising a concrete intelligent schedule measure transforms to make the optimal policy

with multiple indices in the heterogeneous environment parallel computing network system under the determined conditions. In theory, this kind of problems can be solved through solving the minimum solution of the cost function, usually ,this kind problems with complicated prerequisite are NP-perfect problems, the optimal solution can not be obtained, so in the real engineering field, some elicitation algorithms with sub-optimal indices are studied and applied, some research results are published in some literatures[9-10].

Based on the above thinking, a novel intelligent schedule measure is pointed out, the main idea of this schedule measure is to build up the resource allocation function of the network system based on the computing tasks which the network users are asked for, then a cost function with multiple indices in the heterogeneous environments is designed in, through solving the minimum solution of the cost function, then the concrete intelligent schedule measure is to be realized. The whole process of realizing the intelligent schedule measure can be divided into three steps. In the first step, based on the computing tasks which the network users require, after the scale of the total computing tasks is estimated, then the total tasks are cut apart many sub-module tasks, all of these sub-tasks with grain requirement are coded and to be regarded as independent sub-module tasks, it is named task allocation function and denoted $F(n_1, n_2 \cdots, n_i, \cdots, n_j)$, n_i is the i^{th} sub-task module. In the second step, in the heterogeneous environment in grid network, a computing resources function with multiple variables and parameters is defined, the variables and parameters of the resource function correspond to the performances of independent computing system or platform with their computational powers, this defined function is denoted $H(m_1(k_1), \cdots, m_i(k_i), \cdots, m_j(k_j), \cdots, m_l(k_l))$, here, $m_1(k_1)$, $m_i(k_i)$ and $m_j(k_j)(i, j = 1, 2, \cdots, l)$ respectively express the computing resource property index of the first, the second and the i^{th} processor in computing resource function, this computing resource function can shield the original heterogeneous environment conditions of the Grid Computing Network system with a making mapped treating process. In the third step, based on the properties and specific requirements of the computing tasks and the computing resources, an one-to-one mapping between computing tasks and computing resources is build up, the mapping means that computing resource function matches the task allocation function, to denote this mapping $\Pi(\cdot)$, then the above description can be written:

$$\begin{cases} H(m_1(k_1), \cdots, m_i(k_i), \cdots, m_l(k_l)) \\ = \Pi\{F(n_1, \cdots, n_i, \cdots, n_j)\} \\ n_i \to m_i(k_i) \end{cases} \quad (1)$$

It is expressed with the chart style as follows:

Table 1: the relationship with two different functions

$H(m_1(k_1), \cdots, m_i(k_i), \cdots, m_l(k_l))$				
$m_1(k_1)$	.....	$m_i(k_i)$	.....	$m_l(k_l)$
↕	↕	↕		
n_1	.....	n_i	.....	n_j
$\Pi\{F(n_1, \cdots, n_i, \cdots, n_j)\}$				

In here, the sub-task module n_i matches $m_i(k_i)$, it also means that the task requirements adapt to the independent proceeding processor or computer. Because the computing resources match the computing tasks, so the subscript l is always equal to subscript j, then through this kind of allocating method, the whole schedule measure is accomplished.

Based on this kind treating to finish the schedule measure in the Grid Computing system, then the

resource function can shield the concrete heterogeneous network environment, so it can come over the bottlenecks and restrictions which are caused by the heterogeneous network environment and different computing units. According to the above discussion, then a reasonable and feasible cost function with two performance index variables can be built up, one performance index variable expresses the total treating time, another performance index variable expresses the computing resource utilization ratio, then to realize the intelligent schedule measure transforms to make the total time tend to the shortest and make the utilization ratio tend to the highest, then through solving the minimum solution of the cost function, the intelligent schedule measure also realize.

But, in fact, the situation that these two performance indices are satisfied in the same time hardly appears, it means the global optimal solution is not always to appear, because of this reason, to solve the sub-optimal solution of the cost function is usually used. As a simple case, if the performance index variables are linear to the cost function which is denoted $\Phi(\zeta,t)$, then the cost function can be built up as form (2):

$$\Phi(\zeta,t)=\alpha\zeta+(1-\alpha)\sum_{i=1}^{j}t_i \tag{2}$$

Here, α is a weight coefficient, and $\alpha\in[0,1]$; ζ is denoted $\zeta=1-\eta$,which corresponds for the resource utilization ratio η , $\eta\in[0,1]$; t_i is the total time of the pre-proceeding and communication of the i^{th} sub-module, so to choose the intelligent schedule measure transforms to solve the solution of $\min\Phi(\eta,t)$, furthermore, the ordinary mathematical model of the optimal schedule measure with multiple performance index variables is described :

$$\min_{conditions}\{\Phi(\chi_1,\cdots,\chi_i,\cdots,\chi_k)\} \tag{3}$$

Here $\Phi(\chi_1,\cdots,\chi_i,\cdots,\chi_k)$ is the cost function with multiple variables that are based on the task requirements of the Grid Computing Network, the linear cost function is built up as form(4)

$$\begin{cases}\Phi(\chi_1,\cdots,\chi_i,\cdots,\chi_k)=\sum_{i=1}^{k}\alpha_i\chi_i\\ \alpha_i\geq 0\\ \sum_{i=1}^{k}\alpha_i=1\end{cases} \tag{4}$$

Here, α_i is weight coefficient too, and $i=1,2,\cdots,k.$.

The intellectual ability of the schedule measure also embodies the mutual influence between the Grid Computing network system that provides computing resources and the Grid Computing network users demand the computing requirement, when the cost function is built up , the expectation and requirement of the Grid Network users can also emerge, especially, the choice of the performance index variables and the number of parameters are ascertained with the computing requirement of the users, the weight coefficients are confirmed with the special computing requirement of the network users, In a word, this intelligent schedule measure is an optimal or sub-optimal scheme that can base on the special computing requirement of the network users, it does the best to demonstrate the personality and agility of the grid computing network system.

4. Conclusions

The intelligent schedule measure in the Grid Computing network system is one kind kernel technologies, it can rapidly enhance the network utilization ratio of the computing resource through avoiding the extra loss, furthermore, it also can enhance the validity, availability, security and

reliability of the Grid Computing Network system, it also expresses the noted advantages of the new computing technologies. Furthermore, the properties of the intelligent schedule measure algorithms also become the symbols of the advantages of the Grid Computing Network technologies.

In the heterogeneous environment, to realize the intelligent schedule measure transforms to solve the minimum solution of the cost function with multiply performance indices variables, and based on the computing requirement of the Grid Computing network users, it is relatively easy to construct the computing allocation functions, the computing resource functions and the cost function, so this new intelligent schedule measure is not only to provide a way to realize the assignment measure, but also to realize the best performance indices and characters of the schedule measure.

5. References

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