Research on Energy Saving Distribution in Cloud Computing Environment

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Abstract. With the huge increase of cloud infrastructure and the continuous expansion of cloud computing scale, the consumption promotion role of IT resources has been increasing, which has greatly hindered the development of IT industry. Energy consumption has become an important factor restricting the development of cloud computing. How to reduce energy consumption and improve the efficiency of energy utilization in cloud computing has become a new problem. At present, most of the cloud computing task scheduling algorithms are also carried out in job scheduling, which does not consider the allocation and energy consumption of resources. Therefore, the rational allocation of resources is an effective way to improve the efficiency of energy utilization and energy utilization. In this paper, the concept of resource waiting and resource consumption is proposed. It is considered that resource allocation is an effective way to improve the efficiency of platform software. In this paper, the resource space time energy consumption of intelligent energy is defined. The optimal ratio of known energy consumption to 0 and the resource needed for resource tasks and tasks is called map / task allocation and resource allocation. In this paper, the best resources than W test and wait for the relationship between the specific energy and resource; then, to verify that the map / mountain ice task division rationality by experiment; then the experimental data to verify the R2 algorithm can reduce the energy consumption of resources, improve the utilization rate of node resources, optimizing the energy efficiency of Map/Reduce task. The proposed resource ratio model and resource W method can be applied to existing map reduction system, which is of theoretical significance and practical value for improving and optimizing energy efficiency in cloud computing models.

Keywords: Cloud computing, high energy efficiency, resource allocation, method research, resource model

1. Introduction
As a great innovation of information industry, cloud computing model has been widely concerned by the industry and academia. As cloud computing continues to expand the scale of resource consumption hit increase, lead to a big increase in the cost of cloud computing. The huge energy consumption in the
data has become a difficult problem in the field of cloud computing. Under such background, how to reduce the energy consumption and improve energy efficiency, reduce energy consumption is an effective way to optimize the energy consumption. Map Reduce is a programming model, but also a method to deal with and generate large data sets of the algorithm model of the relevant implementation. Map reduce architecture of the program can be in a large number of ordinary configuration of the computer to achieve parallel processing. This paper chose the open and widely used by developers and research personnel to accept Apache Hadoop skillfully. In this paper, the main research content is divided into two parts: firstly, the definition of a common resource model, and its application to the Map / Reduce task; secondly, how to skillfully research based on the model and the distribution of the target task required resource prediction and allocation, resource allocation algorithm is proposed[3].

2. Topic related model introduction

2.1 Resource model
This section respectively face some concepts from the computer and the task of two party, such as computing resources, node resources, task resource assignment, task using resources is defined of algebra and resource space calculus, to explore the query ability and expression ability of the resource space model. The algebra consists of a set of operands and a set of operations defined on the number of these operations to satisfy the closed operation. Calculus is a first-order predicate logic defined on the data model, which can describe the user's query results. The calculus can be used to describe the user's needs, and the algebra is used to calculate the results of the query. The algebra of the resource space model consists of 5 basic operations of the resource space model[5]. N-dimensional space resources of the visual interface as shown in Figure 1.

![Figure 1. An n-dimensional space visual interface resources](image)

2.2 Energy consumption optimization
For the virtual machine granularity energy consumption measurement technology, because the cloud computing system needs the data support of energy consumption measurement and monitoring to complete the automatic or manual energy consumption management decision, so the measurement of energy consumption usage is a very important aspect of energy consumption management technology. Most of the energy consumption monitoring of physical cluster is realized on the hardware level. Most of the new servers provide energy consumption measurement function on the hardware level, or use energy distribution unit and other solutions to realize energy consumption measurement on the
physical level, so as to meet the needs of energy consumption management in the data center. In the virtual cluster, because the energy consumption of virtual machine cannot be measured directly by hardware, the method of measuring the energy consumption of virtual machine generally adopts the black box method to capture the energy consumption of virtual machine. The basic method is to first establish the energy consumption model, which links the utilization rate of some resources with the energy consumption of the whole system, and then input the real-time monitoring resource utilization rate to indirectly calculate the energy consumption value of the virtual machine. Because of the high cost of cluster virtual machine, it can't measure the energy consumption accurately. For energy-saving optimization technology, first of all, static energy-saving technology can be adopted. At the beginning of component and system design, energy consumption factors are considered, including energy-saving technology of circuit layer and transistor layer, low-power design of processor, memory and disk. These designs are transparent to software. Second, dynamic management technology can be adopted to adjust and schedule resources dynamically and adaptively according to performance requirements and load changes, and energy consumption optimization at cluster level can be realized through certain strategies and management software. Model schematic diagram shown in Figure2.

![Figure 2. An example of energy consumption optimizing data placement algorithm](image)

### 2.3 Task stage model

The essence of task scheduling is to establish a reasonable mapping relationship between tasks and resources, that is, mapping m tasks to N available resources, so as to realize the efficient execution of tasks. The task scheduling algorithm is closely related to the task scheduling problem. According to the different rules of mapping tasks to resources, different task scheduling algorithms are formed. The resources of cloud data center are heterogeneous and large-scale, that is to say, the configuration of data center resources by cloud service providers is quite different, which may be server nodes with high performance or computer nodes with general performance. Different hardware devices lead to great differences in the service performance of resources. The large number of cloud users and different types of cloud users lead to cloud computing. There are many kinds of tasks and obvious differences in the environment. Traditional desktop computers, laptops, tablets, smart phones and other new networking devices can request cloud computing resources. In other words, any device on the Internet can access the resources of the cloud data center. The different types of tasks lead to the complex and diverse needs of cloud users for resources and the lack of resources. The degree of urgency is not the same; the number of resources in cloud data center is constantly changing. For example, in the process of the development of cloud computing system from the initial stage to the stable stage, resource nodes need to be added. In the process of the development of cloud computing system from the stable stage to the late stage, the number of resource nodes will be reduced due to node failure, and the number of resource nodes will be reduced throughout the operation of cloud.
computing system. During the process, the internal structure of resource nodes is constantly changing. These characteristics make the task scheduling problem in the cloud computing environment become extremely complex. Task scheduling in the cloud platform must have the ability to select the better resource nodes from the resources available in the data center to perform tasks. Due to the different parts of the algorithm for complex tasks, each part of different data processing methods, task throughput will be different, if you use a fixed amount of resources model and swallow model to describe the entire task is quite simple, and it is difficult to find the optimal resource ratio, so to divide the task. The task is divided into more fine-grained resource use, resource and task characteristics.

Figure 3. A new model of resource allocation

Figure 4. A new resource allocation model data flow diagram

3. The provision of resources based on Reliability

3.1 Cloud computing resource management
Cloud computing resource management is to accept the user's request for resources, and the specific resources allocated to the resources of the request, mainly including data storage and resource management in 2 Cloud storage access types and access methods are also different for different service providers[10]. The cloud model is shown in Figure 5.
3.2 Cloud resource scheduling
Cloud computing has a large number of resources, resource management mechanism should also be a logical integration of these resources to the integration of a single integrated resources to the user. Therefore, the effectiveness order to truly play the role of cloud computing. Cloud computing design class diagram shown in Figure 6.

3.3 Energy efficiency evaluation model
Effective energy per unit of energy to complete the task, therefore, the energy efficiency metric has two parts, one is the system energy consumption, and two is an effective system to complete the task, due to the different res other auxiliary equipment, this study considered, because send some equipment not directly involved in the execution of tasks, its energy consumption is difficult to pass through the "software" optimization method[12].
4. Research on Application of ant colony algorithm in cloud computing resource allocation

In nature, ants can always find a best way to feed back to their nest. The real ants are small and have little vision and no language communication. Therefore, the search for the optimal path in nature cannot be carried out by visual acuity or language communication among individuals. Dorigo and other scientists have found that this is mainly due to the fact that the ant colony releases a secretion called pheromone where they travel. Through the introduction of section 3.3.4, we know that the pheromone mechanism of ant colony is a positive feedback mechanism, which is precisely because of the interaction between pheromone and ant, which leads to the ant colony to find a shortest path to feed back to nest. In the real ant colony system, similar to the actual situation of roulette, a few ants choose the suboptimal path. Based on this mechanism, ant colony will not give up the opportunity to find new optimal solution because of the existing optimal path. If there is a new optimal solution when the environment changes, the length of the path should be shorter than other paths, and the concentration of pheromone in the path will show an upward trend in unit time. Because of the positive feedback mechanism of pheromone, ant colony will gather on the shortest path in the new environment, and find the optimal solution in the current environment.

In cloud computing, the energy consumption of the system is still mainly the energy consumption generated by the physical resources when they perform tasks. The energy consumption value is equal to the product of the power and time of the physical resources. The power of the physical resources will change with the change of time and load in different working states. According to the viewpoint proposed in document [4], the energy consumption model in cloud environment mainly considers three aspects of energy consumption, namely, calculation energy consumption, storage energy consumption, and data transmission energy consumption. Other energy consumption such as system components such as motherboard, display, power supply and other system components is limited due to the limited space for improvement by scheduling algorithm, so it is not considered in the energy consumption model for a while. The calculation energy consumption is the energy consumption generated by the high speed operation of CPU and memory when the host computer performs the calculation. The calculation energy consumption occupies the most important part of the system energy consumption. Storage energy consumption refers to the energy consumption caused by frequent read and write operations on disk, which is determined by the speed of reading and writing, the size of read-write data and disk power. Data transmission energy consumption is the energy consumption generated by the transmission of a large amount of data between nodes, which is mainly affected by the network topology, bandwidth, delay, data amount and transmission time in cloud environment. In the two-level scheduling of cloud computing, there are more researches on the scheduling of cloud tasks at the first level. The scheduling of cloud tasks requires that the completion time and load balance of cloud tasks be as short as possible under the premise of satisfying the QoS of users. This is the scheduling target function of ant colony algorithm.

4.1 An overview of the application of ant colony algorithm in cloud computing resource allocation

A resource allocation strategy based on ant colony algorithm is proposed for the cloud computing resource scheduling model. Distribution of cloud computing resources, cloud computing community found first in the network on Internet, distributed computing (Distributed Computing) (Parallel Computing), parallel comp work together. Mainly includes three kinds of levels of service: the infrastructure namely service (IaaS), the platform namely service (PaaS) and the software namely service (SaaS).

4.2 Cloud computing service model.

In the cloud computing service model, user interface with Web Service for a variety of user access interface, to obtain use of the unique characteristics of the resources in cloud computing, such as autonomy and virtualization, the original distributed computing resource allocation and scheduling algorithms can not work effectively in this environment. In the cloud computing, the efficiency of resource allocation is very important, which has great influence on the system performance of the
cloud computing platform[14].

4.3 Model and its parameters
Slave node domain as an undirected graph $G(V, E)$, where $V$ is the area of all slave nodes in the Area collection, $E$ is connected to the slave nodes of the network collection. In the cloud computing network, it is divided into $s$ following graph is used to complete the task of the algorithm and the optimal algorithm task completion time, computing power preference class tasks and bandwidth preference task comparison chart. The simulation results are shown in Figure 7.

![Simulation Experiment Results](image)

Figure 7. Schematic diagram of simulation experiment results

5. Summarize and Expectation
In the existing Map Reduce cluster environment, task scheduling and resource allocation unreasonable will lead to the low utilization rate of resources, therefore, can be from W to improve resource utilization, improve energy efficiency to solve the problem. This topic by proposing a resource allocation method for high energy efficiency, so that each task is to obtain a reasonable CPU. Disk, network computing resources, and make full use of the resources of each node, and reduce the bottleneck of resources, energy consumption for generation. In order to more general and can be applied to the theory, this research will include the study of different opportunely the computational complexity of the instruction cycle, given task related parameter estimation method and simplified Map Reduce resource ratio model, makes the calculation more simple two aspects, and in a more massive data model to detect large the integrated environment.

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