Resource Allocation and Scheduling Theory Based on Distributed Environment

Zhao Yue *,**, Qian Xu *

* School of Mechanical Electronic& Information Engineering, China University of Mining & Technology, Beijing, 100083, China

** Beijing Electronic Science &Technology Institute, Beijing, 100070，China

zhaoyue@besti.edu.cn

Abstract—**Calculation processing technology based on distributed environment is a focus in the field of computer research. Based on the distributed environment, resource allocation and scheduling of distributed computing is very important and hard to resolve. E-commerce website different from the earliest C/S architecture has a quickly developing with distributed architecture. This paper analyzed the model of E-commerce website, show the basic service elements of e-commerce sites. Then a distribute system architecture is proposed, and some research points are listed, such as its distributed system architecture, resource scheduling, virtual cloud resources scheduling and configuration issues.**

Keywords— **Distributed Environment; Resource Allocation; Resource Schedule; Cloud virtualization resource; system architecture**

I. INTRODUCTION

Calculation processing technology based on a distributed environment is a focus in the field of computer research. Distributed computing is a science of computer, which studies how an enormous computing power to solve the problem is divided into many small parts, these parts assigned to a number of computer processing, the final results of these calculations together to get the final results. The so-called distributed computing can share information with each other between two or more kinds of software, the software can either run on the same computer, also can run on multiple computers connected by a network [5].

Based on the distributed environment, resource allocation and scheduling is one of the area of distributed computing is a very important problem and difficult to resolve [6-14].

II. ANALYSIS OF KEY TECHNOLOGIES

Distributed environment, including a number of known technologies, including distributed computing, parallel computing, P2P technology, grid computing, and cloud computing technologies[1-5].There are many similarities between the above technique, but not exactly the same. Based on the distributed environment, resource allocation and scheduling theory is to enhance the overall computing power of the system to improve system performance. Existing technology related issues have been a number of studies, and a brief analysis of the research background and current status is followed.

A. Distributed Computing

1) The concept of distributed computing

Distributed computing is a computer science major study of distributed systems [5]. A distributed system consists of a number of interconnected through the network computer. These computers complement each other to complete a common goal. The specific process is: compute-intensive project data need to be split into small pieces, were calculated by multiple computers, then upload the result of the operation after the unification of data obtained conclusions. Programs running on a distributed system are called a distributed computing program; distributed programming is to write the program.

2) Distributed computing work

A large computing tasks can be divided into several small pieces (work units), calculated via the network to a number of distributed systems, the completion of the calculation through the network to the respective calculation result is returned to the originator of the task.

3) The advantages and characteristics of distributed computing

Distributed computing has the following advantages:
- Scarce resources shared, including computing resources, storage resources, peripheral resources;
- On multiple computers, distributed computing can load balance calculations;
- Run the program on the most suited computer;

Among them, the sharing of scarce resources and load balancing is one of the core ideas of computer distributed computing.

Characteristics of distributed computing can be described as follows:
- Resource sharing: hardware, software, and data information sharing system resources;
- Distributed processing platform: to show to the user a unified whole system;
- Cost-effective: a distributed system with high performance and low cost;
- Application distribution: the majority of the application itself is distributed;

- High reliability: Modern distributed systems with a high degree of fault tolerance mechanisms;
- Scalability: Add a few PC can improve the performance of the system;
- A high degree of flexibility: compatible with different hardware vendors' products, machines and peripherals compatible with low-profile and high-performance computing.

4) Distributed computing problems.

Calculation task is complex and diverse, including not only simple mathematical calculations, but also includes a number of tasks such as data analysis and processing, including space exploration, information retrieval, life sciences analysis task requires a strong computing power support [6]. Distributed computing can effectively take advantage of the idle processing power of networked machines around the world to help the lack of financial support, tasking limited computing resources, and accelerate the process of human science. Such problems are generally interdisciplinary, challenging, human beings need to be solved research projects. One of the more famous:

- Solve more complex mathematical problems, such as the GIMPS (look for the largest Mersenne primes).
- Research to find the most secure password system, such as the RC-72 (password cracking).
- Bio-pathological studies, such as Folding @ home (to study protein folding, misunderstanding, polymerization, and the resulting disease).
- Wide variety of diseases research, such as the United Devices (find effective drugs to fight cancer).
- Signal processing, such as SETI _AT_ Home (home to find extraterrestrial civilizations).

In addition, with the distributed computing technology matures, many new applications continue to emerge.

B. Research significance and value

Sharing of scarce resources and load balancing is one of the main ideas of distributed computing, cloud computing and virtualization technology. Based on the above background, this paper proposes the research of resource allocation and scheduling theory in the distributed computing environment. Focusing on Distributed system architecture, distributed computing resource allocation theory, distributed resource scheduling algorithm, virtual cloud resources scheduling and configuration issues in-depth study, research subject is the current hot issues and the difficulties of computing technology research areas. Improvement and development of computational theory has important research significance and value.

III. DESIGN OF THE E-COMMERCE WEBSITE BASED DISTRIBUTED TECHNOLOGY

E-commerce website different from the earliest C/S architecture has a development of a distributed architecture. E-commerce website is a business application system running the main bearer and reflecting the earliest commerce site using client/server architecture, including network server, the client browser, and HTTP protocol or application functionality. With

the rapid development of computer networks and communication networks, e-commerce applications have rapid development of online shopping. Now, a number of e-commerce sites, such as Taobao, Jingdong, Alibaba, Amazon and others, handle large amounts of distributed data request everyday. So we try to propose a new framework which can support business applications for large data.

The above analysis of the architecture platform and research focus on distributed architecture from different levels and angles, the research question focused on different aspects of the distributed system. Typical system architecture can provide us with a platform for better analysis of the problem, including a representative, Hadoop architecture, which learned from Google's MapReduce framework on the basis of development [3]. MapReduce architecture is more suitable for large data search applications, such as Web search engine architecture through the use of special software robot, spider, find pages of billion record the number of network information, build a query to find the list of words and development of a metadata database in the background to achieve fast retrieval. Before the analysis of a representative architecture including HDFS, Mapreduce, Hbase, Hive and other platforms are factored out from the Hadoop project.

The architecture is applicable to a large amount of data retrieval. The search request is relatively simply, the retrieval time requirements the short search, data retrieval of applications, but is not entirely suitable for some other distributed application, such as e-commerce platform-- Taobao, Jingdong, and online shopping applications, such as the railway booking system website of China—12306.cn. By its very nature, it is also distributed request, and the characteristics of the application are different from the search-type applications. The requests are usually the case of real-time data retrieval, and the corresponding search engine. Search results usually use the spider static search results. This application is usually the application of e-commerce, often connected with e-commerce payment platform, and need to connect it through an encrypted connection to ensure the reliability, safety certification network. This type of application can be collectively referred to as "electricity supplier application". Such applications database search is not as complicated, but the more important data concurrency and data collaboration between interlocking, security, fault tolerance, and parallel read and write more prominent. Similar promotional activities, or network ticketing systems regularly open votes in the e-commerce platform, demonstrated by the large amount of data concurrent access on system architecture cause greater impact.

E-commerce solution is usually divided into direct programs and integrated supply chain solutions. Direct marketing programs commonly used in retail sales, a business organization is to attract customers through the virtual store, customers can get the desired browser. And online virtual stores can also advertise to the user, and make a discount, promotional. Supply chain integration objectives of the program will send a dynamic flow of data to contact trade partners around the world, real-time data. To achieve this goal,

all the participants involved in the supply chain solutions must adopt unified data standards in order to achieve a smooth and seamless transfer of data. Supply chain integration solutions require different departments to work together to meet customer needs, require participants to develop more effective programs to adapt quickly to changing market conditions.

E-commerce applications to provide online trading and money transfer services. User data based on business rules processing, order processing, and exchange of information, promotion and advertising; according to business rules processing business data, business data storage and retrieval, directory management, security management, and communication services, development components, enterprise database and the necessary tools. Figure1 show the basic service elements of e-commerce sites.
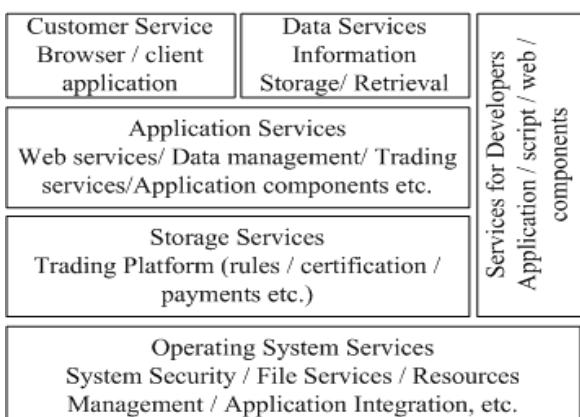

Figure 1. The basic service elements of e-commerce sites

Ordinary distributed processing applications are generally prepared in advance good static data, the data change, slow web content updates. Search for business applications, such as Google, launched its search results are usually based on search keywords before other users have submitted in advance by the system in the background through the spiders crawl the entire Internet to obtain useful data page. The data has been saved in the Google database system by the classification process. The new user's search process is only in the system database will be set up data relationships re-rendered in a web page. Another example mail service--Gmail, Gmail service developed by Google Inc. for user's e-mail stored in the distributed storage system.The user's e-mail content updates slower, smaller amount of data, these characteristics determine the ordinary distributed processing in the database design process does not need too much to consider data concurrency, mutual exclusion, and fault tolerance features.

E-commerce site is different from the ordinary distributed applications, its main business data processing, complex data types, large amount of data flows, frequent exchange of data, and therefore the efficiency of the operation of the database directly affect the efficiency of the entire e-commerce system, the data Security is also a direct impact on the normal safe operation of the system.

Based on the above analysis, we can see, E-commerce distributed applications different from the early days of distributed computing tasks assigned, the development of distributed data crawling, It has massively parallel processing to distributed data, the core architecture for different applications, the performance different characteristics.

E-commerce site system resources are mainly concentrated in data processing, followed by services and management, and finally the text browser. Construction site equipment, development, software should be more than 50% of the inputs used to improve the efficiency of the system. Concurrent data processing efficiency should also be considered when designing a database because the database itself is quite different concurrent, database structure is designed to consider how to classify the data and make the necessary load test to identify concurrent programs of the highest processing efficiency.

The topic carry out the research of distributed architecture based electricity supplier business applications features, which study its distributed system architecture, resource scheduling, virtual cloud resources scheduling and configuration issues.

IV. RESEARCH POINTS OF THE TOPIC

A conclusion may review the main points of the paper. Please do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Based on the above analysis, some research points are listed, such as its distributed system architecture, resource scheduling, virtual cloud resources scheduling and configuration issues. Figure2 show the research points of the topic, we will give the results of research in the other papers.

A. A distributed system architecture research

This paper based on the advantages and disadvantages of existing distributed systems, intends to combine research focus, based electricity supplier class business distributed resource allocation and scheduling problems, proposes a distributed computing framework.

Distributed system architecture designed for large data, the large volume of business platform application design, usually have very high demands on performance, huge amounts of data, fault tolerance and scalability [8], so the architecture of the system can not simply the centralized. Performance requirements: *1)*. Distributed data storage, *2)*.Request distributed scheduling, *3)*.Multi-node distributed deployment, *4)*.Double backup and warm standby.

The system design is the most important network architecture, distributed resource allocation, resource scheduling and inter-module communication. We will study the distributed system architecture required the design of distributed framework, the framework needs to provide parallel computing model, computing power for multi-machine multi-core processors; provide distributed cache for the use of multi-machine memory capacity; like operating a local file exactly as the remote file is used to take advantage of the remote multi-machine hard disk storage capacity; complete distributed
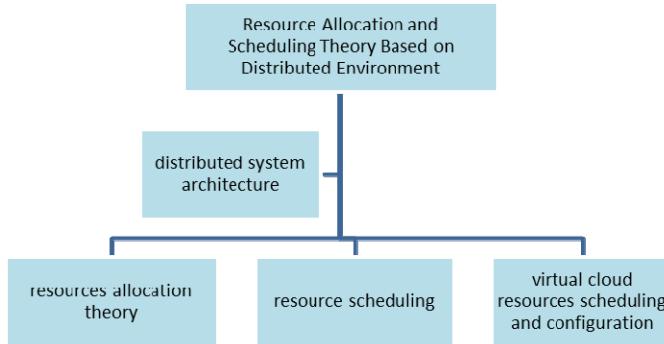
Figure 2. Research points of the topic

collaboration and lock for multi-machine collaboration and communication. The framework needs to put forward a simple and easy-to-use API interface, more than one computer processor, memory and hard disks, in order to gain greater computing power to solve complex problems.

Design new distributed framework to be adopted by the polymerization or more machines used to calculate the CPU and memory utilization, to solve the problem of large quantities and computational complexity.

B. the allocation of resources in a distributed environment theoretical research

Proposed a resource allocation method based on game theory, to achieve a balanced distribution of computing resources, to achieve load balancing.

Game Theory applied to solve the existing problems in theoretical computer studies has a long history. Such as the use of incentives for protocol design, analysis of user selfishness in the existing design of resource allocation mechanisms influence on the results, in order to meet user selfishness and mechanism-based design method. The market mechanism-based computing in the field of artificial intelligence and game theory also has important applications [12].

Game theory, the case of a branch of applied mathematics, has become one of the standard analytical tools of economics, which has a wide range of applications in biology, economics, international relations, computer science, political science, military strategy, and many other disciplines. Interaction between game theory formulated and incentive structure is the study of mathematical theories and methods of struggle or the competitive nature of the phenomenon, which is also an important operational research disciplines. Game theory considers the predicted behavior and actual behavior of individuals in the competitive game, and studies their optimization strategy.

This topic intends to establish a mathematical model of the problem to achieve an efficient allocation of resources distributed task.

C. Distributed Resource Scheduling Algorithm

The topic intends to propose a linear matrix inequalities resource scheduling algorithm to achieve the resource scheduling decisions.

Distributed Resource scheduling algorithm is a theory of dynamic resource scheduling control. Resource scheduling is

dynamically variable to a certain extent, which is different from the allocation of resources, the need for the system input feedback processing [14].

Linear matrix inequality approach is the method commonly used in the system control theory. Control theory of large-scale systems often requires input and output conditions for feedback regulation. TS fuzzy control system is a common control model. The distributed resource scheduling algorithm, mathematical modeling, the input and output conditions using linear matrix inequality approach is to be studied to obtain resource scheduling function for the processing system, and the optimal solution.

This topic intends to use the resource scheduling algorithm based on linear matrix inequality approach, modeling distributed resource scheduling decisions, intelligent processing to achieve the optimal solution.

D. Cloud virtualization resource scheduling and configuration

Based on the cloud computing platform, this topic will propose virtualization cloud resource allocation and scheduling policies. Virtualization is a broad term, in simple terms, is the computer module on the basis of the virtual rather than real physical hardware based on operation [12]. According to the different resources demand, virtualization will reschedule the resource in order to achieve the maximum utilization of the data and the purpose of enabling simplified management, resource optimization solutions.

Traditional enterprise IT model determines the network administrator must manage large amounts of server systems. With the large number of fragmented server system, the administrator is difficult to achieve the sharing of system resources. Distributed system partition is an important tool for dynamic scheduling system hardware resources. VMware are logical partitions on a single x86 architecture hardware platform which can concurrently run multiple operating systems. This feature can be different applications running under different operating systems in the same server platform, and mutual security isolation from viruses or system crashes caused by an application. This will achieve integration of many small or medium-sized applications, and unified management, also balanced hardware resources to achieve the best optimization of resources.

The current cloud computing resources in the environment is a virtual machine resources, specifically through the use of virtualization technology to a variety of data center hardware resources virtualization, to form a virtual resource pool, the dynamic deployment of virtual machines to transparent to the user.

This topic will propose a virtualization-based cloud resource allocation and scheduling policy, a set of hardware resources to reorganize the logic of computing power resource pool, so as to realize the dynamic equilibrium distribution of these computing resources. Pre-defined resource allocation principles, according to business needs and the importance of business and continue to monitor the utilization of the resource pool dynamically allocate resources for the virtual machine.

The proposed scheduling policy allows users to define their own policies and rules to determine how to share virtual machines optimize the use of existing resources and how these

resources between multiple virtual machines. When the load of an application increases, the policy of resource allocation will be analyzed according to the pre-formulated rules. If the application meets the requirements, the additional resources will be allocated to the virtual machine. With the increase of resources for virtual machines, virtual machines can migrate to other servers with more resources, or migrate to other servers to save more resources achieved in two ways.

V. CONCLUSION

As mentioned above, resource allocation and scheduling in distributed environment is very important and hard to resolve. E-commerce website different from the earliest C/S architecture has a quickly developing with distributed architecture. This paper analyzed the model of E-commerce website, show the basic service elements of e-commerce sites. And some research points are listed, such as its distributed system architecture, resource scheduling, virtual cloud resources scheduling and configuration issues. We will give the results of research in the next papers.

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