Applied Mathematics & Information Sciences
An International Journal

http://dx.doi.org/10.12785/amis/090159

Research on Improvement of Task Scheduling Algorithm in Cloud Computing

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Received: 26 Apr. 2014, Revised: 27 Jul. 2014, Accepted: 28 Jul. 2014
Published online: 1 Jan. 2015

Abstract: In recent years, cloud computing has been focused as a new mode of service in the field of computer science. This paper starts from the definition, key technology and corresponding characteristic that are reviewed from all the aspects of cloud computing. As found in both literature and practice, the cloud computing face the grand quantity of the user groups, as well as the quantity of tasks and massive data, so the processing is also very significant. How to schedule tasks efficiently has become an important problem to be solved in the field of cloud computing. For the programming framework of cloud computing, a dual fitness genetic algorithm (DFGA), it can get shorter total task scheduling completion time and better results, and the results of the scheduling task average completion time is also shorter. Through the simulation experiment of this algorithm, compared with other algorithms, the experimental results show that, this algorithm is better than adaptive genetic algorithm, which can be an efficient task scheduling algorithm in cloud computing environment.

Keywords: cloud computing, task scheduling, algorithm improvement

1 Introduction

In the last five years, cloud computing has from the original (Twentieth Century 90 time metaphase) proposed by people to become a hot question studied in academic and industrial circles. According to the America market survey firm Gartner magazine in 2011 10 strategic technologies in cloud computing, he ranked first.

The rapid development of cloud computing indicates that the technology can bring a bright prospect and more economic benefits [1]. The so-called cloud computing, which is simply to virtualization technology as the foundation, take the network as the carrier, to the user as the main body to provide infrastructure, as its platform, software and other services to form, the supercomputing service integration mode of massively scalable computing, storage, data, application of distributed computing resources for collaborative work.

Cloud computing is a computing method based on the Internet, by this way, the sharing of hardware resources and information can be provided according to requirements to computers and other equipment, mainly is the increase in Internet related services, use and delivery model based on, usually via the Internet provides dynamically scalable and often virtualized resources [2]. Cloud is a metaphor, the Internet network. In the past in the figure are often used to represent the network cloud, was also used to represent the Internet and the abstraction of the underlying infrastructure. Cloud computing refers to the IT infrastructure delivery and usage patterns, through the network to on-demand, easy extension ways to obtain needed resources; generalized cloud computing service delivery and usage patterns, through the network to ondemand, scalable way to obtain the desired service. This service can be IT and software, Internet, but also other services. It means that the calculation can also be used as a kind of commodity circulation through the internet.

Virtualization can provide good technical support for cloud computing, cloud computing can be regarded as the application virtualization technology. In the past few years, there have been many cloud computing research and development group, such as Google, IBM, Microsoft, Amazon, Alisoft, Huawei, Baidu, Alibaba, nearly all the domestic and international well-known IT companies launched a cloud computing solution. At the same time, the academic circles at home and abroad have on cloud computing and its key technology related theory is studied deeply.

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Cloud computing shared resource dependent to achieve economies of scale, similar infrastructure (such as power network). Resources integration of a large number of service providers for multiple users, users can easily request (loan) more resources, and adjust the amount of use, will not need the resources released back into the entire architecture, so the user does not need to because of short peak demand to buy resources abundant, only enhance the loan amount, the demand reduction they rent. The service provider to the unmanned released resources to other users, and in accordance with the demand of the whole rent adjustment.

Basically, cloud computing is another huge change in the development history of computer technology, after the 1980s when large computer changed into client server. With cloud computing and the related technology, users, who do not have the appropriate professional knowledge, no longer need to understand the "cloud" of the infrastructure in details or directly control the "cloud". Cloud computing describes a new Internet based on IT services increased, with more use and delivery model, usually via the Internet which provides dynamically scalable and often virtualized resources.

2 Overview of cloud computing

2.1 Related concept and its development

At present there is a popular explanation of "cloud computing" why is called "cloud computing": when the Internet just emerging, people drawing used a cloud to the Internet, so in the choice of a noun to indicate the new generation Internet based on a way to count the choice of "cloud computing" this noun. Although this explanation is very interesting and romantic, but easy to let people into the clouds, no positive solution. Since 2007, IBM proposed the concept of cloud computing, many experts, research organizations and manufacturers from different research perspective gives the definition of cloud computing. There are hundreds of definitions about cloud computing, as Wikipedia shows on cloud computing which has always been updated according to different scholars' research and conceptualization, and difference between different versions is very big [3].

According to the latest definition given on Wikipedia updated in 2011: "the cloud is a dynamic scalable virtual resource of software and data to the calculation of user through Internet, like electric power, the user does not need to know the details of the cloud, also won't have the infrastructure that supports the cloud computing management" [4].

Berkeley white defines it as below [5]: cloud computing, including software and hardware facilities to provide these services on the Internet service application and data center. Application service that is SaaS (Software as a service, software as a service), and the hardware and software of data center facilities called cloud. Available to the public through the cloud is called public clouds make both ends meet way, such as Amazon S3 (Simple Storage Service), Google App Engine and Microsoft Azure, and not open to the public organization internal data center cloud called private cloud.

Definition of NIST (National Institute of Standards and Technology): cloud computing is a pattern of resource use, it can computer resource pool with convenient, friendly, on-demand access way through network access configuration (such as network, servers, storage, applications and services), in this kind of mode, can quickly supply and to the minimum management cost to provide services [6].

Sun company thinks, there are many types of clouds, and there are many different applications can use the cloud to construct. The cloud computing is helpful to improve the application deployment speed, help to accelerate the pace of innovation, and cloud computing may be we are unable to imagine. As the creation of this phrase "the network is the computer", Sun company believes that cloud computing is the next generation of network computing [7].

In addition to the above, there are some definitions about cloud computing. The definition of computer of cloud computing is different, Public opinions are divergent. The author thinks: cloud computing is a model of large-scale resource sharing, it is the core technology based on virtual technology, scale economy to drive, with Internet as a carrier, to the user as the main body, in accordance with the dynamic customer requirements to provide virtualization, scalable business model. More precisely, cloud computing is a service mode and not a pure technology. In cloud computing model, different kinds of IT services according to user requirements and construction scale, the dynamic requirements of operation and maintenance, the user generally pay as you go (pay as you go) will pay its use of resources in the network application service fees. Commonly referred to as the SaaS, and the hardware and software facilities for data center resource pool is also cloud [8]. "Cloud" is a virtual computing resources can be self maintenance and management, usually some large-scale server cluster, including the calculation of the server, storage services and broadband resources etc..

To sum up, cloud computing is the development of computing and grid computing, parallel, is a kind of distributed computing, its basic idea is through the network will be huge computing program automatically split into numerous smaller subroutine, to pay the huge system consists of multiple servers, calculation and analysis after the treatment results back to the user through a searcher, and the "cloud" exists to provide these resources of the network. Cloud computing provides service for users is huge, so the "cloud" in the task is enormous, the system time to deal with massive task, so the task scheduling is the key and difficult points in the cloud.

No matter what the scholars defines cloud and cloud computing, in all the definitions, the user can get better service through the browser, desktop applications or mobile applications to access cloud services. To promote the view that cloud computing allows companies to deploy the application more quickly, and reduce the complexity and cost of maintenance management, and allows the IT resources rapidly redistributed to cope with rapid change of enterprise demand. Under such conditions, we can draw a sample architecture how cloud works as shown in Figure 1.

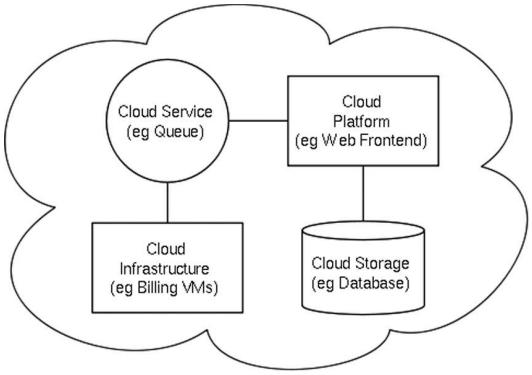

Fig. 1: The sample architecture of cloud computing.

2.2 Delivery modes of cloud computing

There are 3 delivery mode of cloud computing in the principle opinion. Cloud computing service levels can be divided into the infrastructure as a service layer, platform as a service layer and the software as a service layer, market entry conditions from high to low. At present, more and more manufacturers can provide different levels of cloud computing services, some manufacturers also can provide the equipment, software platform, multi-layer cloud computing services.

Figure 2 is a description of the 3 delivery modes of cloud computing, showing how it provides service to the end customers.

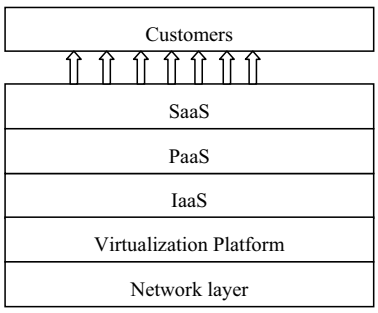

Fig. 2: The 3 delivery modes of cloud computing.

1) SaaS mode: Software as a service
It is a mode that supplies customers software through the Internet. With it, the user does not need to buy the software, but the rent service business operation computing application infrastructure on the cloud. The customer does not manage or control the underlying cloud computing infrastructure, including network, servers, operating system, storage, or even individual application. The function of each module the software system can by each customer customize, configuration, assembly to satisfy the system requirements. Typical CRM relationship management online customer provided by Salesforce (Client Relationship Management) service, Zoho Office, Webex, and Email. In the "software as a service (SaaS)" mode, the user can access the service software and data [9]. The service provider is the maintenance of infrastructure and platform services to maintain the normal operation of. SaaS is often called a "on-demand software", and is usually based on the fees for the use of hours, sometimes the subscription business services. SaaS allows companies to borrow from the outsourcing of hardware, software maintenance and support services for service providers to reduce the IT operating expenses. In addition, because the application is concentrated supply, updates can be real-time release, without requiring the user to manually update or install new software. The defect of SaaS is that the user data is stored on the server service provider, the service provider has the ability to unauthorized access to these data.
2) PaaS mode: Platform as a service
Such mode provide the customer with supplier development languages and tools (such as Java, python, Net) to deploy the application created to cloud computing infrastructure. The core technology is the distributed parallel computing. PasS actually refers to the software development platform as a service, based on SaaS model presented to the user such as the Google App. Typical Engine (GAE) only allows the use of Python and Java language, called the Django Web application framework called GAE to develop an online application service based on.
3) IaaS mode: Infrastructure as a service
Through the network as a standard service provides on-demand elastic infrastructure services, its core technology is virtualization. Can be expensive high performance computer through cheap computer cluster computing ability. The typical such as Amazon's cloud computing AWS (Amazon Web Services) Elastic Compute Cloud EC2 and simple storage service S3, IBM blue clouds.

2.3 Deployment modes of cloud computing

Basically, there are 4 modes of deployment in cloud computing, or 4 kinds of cloud, the private cloud, the community cloud, the public cloud and the hybrid could.

1) private cloud: The cloud infrastructure is built separately for a customer, and provide the most effective control of the data, the safety and quality of service. Private cloud can be deployed in the enterprise data center, also can be deployed on a hosting site, by a single organization owned or leased.
2) community cloud: Infrastructure is shared by several organizations, and is a common concern of community service (such as task, security requirements, policies and compliance considerations).
3) public cloud: Infrastructure is a sales of cloud computing services organizations have, the organization will cloud computing services to the general public or to a large industry group, often in public cloud apart from customer where a building hosting, and by providing a like enterprise infrastructure of flexible even temporary extension, provides a method to reduce the risk and cost of the customers.
4) hybrid cloud: Infrastructure is composed of 2 or more than 2 kinds of cloud (private, community and public), each cloud still remain independent, but combine them with the standard or proprietary technology, with data and the portability of applications (for example, can be used to treatment of sudden load), hybrid cloud helps to provide on-demand and external supply expansion.

2.4 Basic characteristics of cloud computing

For end users and the whole network environment, nearly all the kinds of cloud computing modes, as mentioned above, have the following characteristics.

1) on-demand self-service: users can expand according to their actual needs and the use of cloud computing resources, has the ability to quickly provide resources and services. Can be convenient for computing power via the network application, configuration and calls, service providers can timely resource allocation and recovery.
2) broad network access: by providing self-service through the Internet, users do not need to deploy complex hardware and relevant application software, also do not need to know the physical location of the resource and the configuration information, computing resources can be directly through the Internet or intranet enterprise transparent access to obtain the high performance computing ability. With internet access.
3) resource pooling: the provider's computing resources together, the different physical and virtual resource dynamic allocation of multiple consumers through the use of multi tenant model, and re allocate resources according to the needs of consumers. The allocation of customers have special independent resources, customers usually don't need any control or know the exact location of the provided resources, you can use a higher level of abstraction of cloud computing resources.
4) rapid elasticity: rapid deployment of resources or services. Computing services according to the user demand change quickly and flexibly to realize the resource supply. Cloud computing platform can be rapidly deployed and provide resources according to customer demand. Usually, resources and services can be infinite, can be any number of purchase or at any time. Cloud computing service according to users of resources.
5) measured service: cloud service system can provide measurement model according to the type of service, cloud automatic control system by using the abstract service some appropriate (such as storage, processing, bandwidth and active user accounts) measurement capability to optimize resource utilization rate, can also monitor, control and management of resource use. At the same time, can provide transparent service between suppliers and consumers.

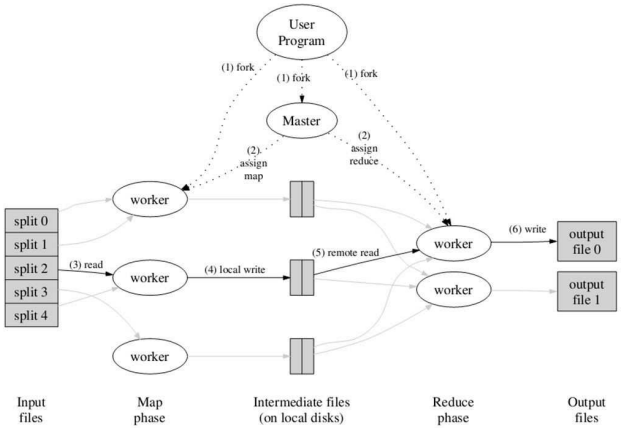

Fig. 3: Executing of Map/Reduce.

3 Key technology of cloud computing

3.1 Programming technology

At present, most of the cloud computing environment proposed by Google Map/Reduce programming model, programming model used in most information technology vendors proposed cloud scheme, is the idea of the development of Map/Reduce based programming tool, it is especially suitable for data generation and processing of large scale set. The implementation process is shown in Figure 3.

As seen from Figure 3, the Map/Reduce includes 6 procedures, all of which can be divided into two main stages:

The Map stage to a large task into smaller subtasks of M through the Map/Reduce function, then the rationing of multiple worker (assigned to perform the Map operation worker) parallel execution, intermediate files output processing; the Reduce phase goes after the Map phase, when the results were pooled analysis processing, output the final result: the *R* output files (*R* is the number of Reduce tasks).

3.2 Storage and distribution technology of massive data

Cloud computing data storage system uses distributed storage mode to ensure the reliability of data redundancy storage way. GFS (Google file system) and HDFS, developed on the base of GFS by Hadoop team, are the most widely used cloud computing data storage system. GFS is a scalable distributed file system, for large, distributed, large amounts of data access application. The design idea of GFS is different from the traditional file system, which is designed for large-scale data processing and Google application characteristics. Although it is running on ordinary hardware cheap, but can provide fault tolerance. It can give a large number of users with high performance service.

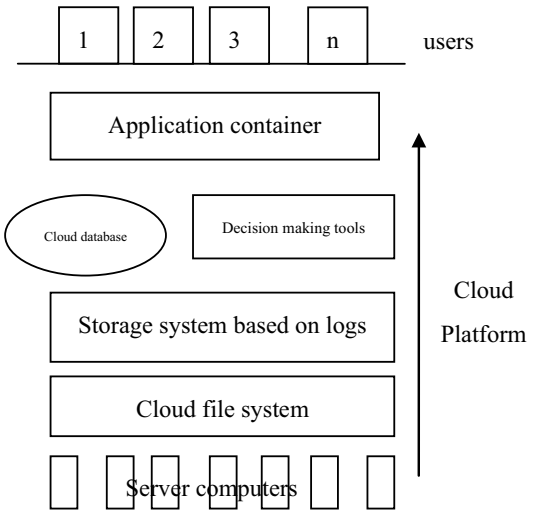

Fig. 4: The architecture of storage service.

As shown in Figure 4 above, the exchange client and server can only be used for metadata operations, communications operation of all data are directly through the application of container and cloud file system associated with the master server, this can greatly improve the efficiency of the system, prevent the main server overload. In order to make the structure more clear, part of the non important module (e.g. access control and task scheduling) is not reflected in the diagram. Like other cloud computing systems, cloud storage service system in this paper is deployed in a computer cluster above. A GFS cluster consists of a master server and block a lot of chunk server, and by many clients access the main server storage.

All file system metadata, including name space, access control information, from the mapping file to the current position of the block. It also control system the scope of activities, such as block lease management, isolated piece of garbage collection, block migration between servers. The server block through regular heartbeat messages with each block server communication, and collect their state information.

3.3 Management technology of massive data

Massive data management refers to the computation, the large-scale data analysis and processing, such as all kinds of search engines. With the Internet as a computing platform of cloud computing to distributed, massive data efficiently and reliably processing and analysis [7]. Google BigTable (BT) data management technology is the mainly used cloud computing data management system; besides, the open source data management module of HBase and Hive developed by Hadoop team, which is an open-source data tool based on GFS, mainly used for the storage and processing of large structured data. BT is built on GFS Scheduler, Lock, Service and Map/Reduce in a large distributed database, different from the traditional relational database, all data were handled as objects, forming a huge table used to store large, distributed structured data.

Many projects use Google BT to store the data, including Webpage query, Google Earth and Google financial. These applications to the BT of each are not identical: the size of the data (from URL to network page to the satellite image), the reaction rate of different (from the rear end of treatment to real-time data service). For different requirements, BT successfully provides flexible and efficient service. Figure 5 is the architecture of BigTable storage service.

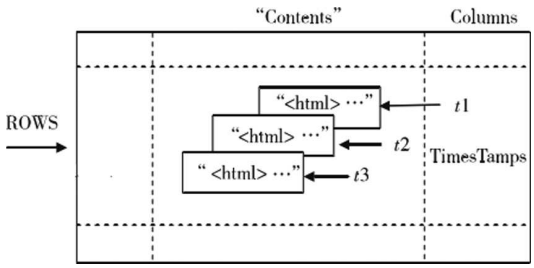

Fig. 5: The architecture of BT storage system.

3.4 Virtualization technology

Virtualization technology is the core part of the cloud computing system, is the key technology of computing and storage resources fully integrated and efficient use of. The characteristics of cloud computing is mainly embodied in the virtual scalable, distributed and dynamic, and virtualized as the main characteristic of cloud computing, cloud computing environment plays a decisive role in building.

Virtualization technology is accompanied by the emergence of computer technology to produce, as the core technology of cloud computing, plays a very important role, provides data center deployment of new and management methods, brought experience efficient and reliable management for data center administrators, but also can improve the utilization rate of data center resources, low function green environmental protection.

Through virtualization technology, deployment of each application environment and physical platform of cloud computing is it doesn't matter, through the virtual management platform, expansion, migration, backup, all operations are completed through the virtual level. The essence of virtualization technology is the realization of software and hardware of isolation, the physical resources change manageable resources as logic.

At present, cloud computing, virtualization technology mainly includes the single resource into a split mode multiple virtual resources, including a plurality of resources into a virtual resource aggregation model. Virtualization technology according to the object can be divided into virtual storage, computing virtualization, network virtualization, computing virtualization is divided into system level virtualization, application virtualization and desktop virtualization.

4 Algorithm improvement of task scheduling in cloud computing

Under the Map/Reduce programming model, how to carry on many of the sub tasks scheduling at the same time is a complicated problem. In cloud computing, by providing services to many users, taking into account the response time of each user, can't keep some users waiting too long.

At the same time, the suppliers also want to consider the user's overall satisfaction, so the average completion time of task will be measured. While some task scheduling algorithm is only concerned with the total task completion time, the maximum waiting time for users, not the average completion time of task focused too much, it will cause the loss of many potential excellent genes, because the average completion time is smaller when the task, to find the total completion time become smaller tasks possible; and in cloud computing and put a user program is divided into many sub tasks to perform, it is more likely to cause the total task completion time is more ideal, and the task to complete an average larger time [8]. This paper proposes DFGA to improve the task scheduling strategy in cloud computing, by optimizing the scheduling of tasks to maximize the efficiency of the cloud computing environment.

In the operating system, scheduling is a kind of self distance distribution, so the scheduling algorithm refers to: resource allocation algorithms based on the specified resource allocation policy system. For the system and the system target different, usually adopt different scheduling algorithm, for example, in a batch system, in order to take care of a large number of period of operation, the scheduling algorithm should be used short job priority; and if in a time-sharing system, in order to ensure that the system has reasonable response time, should be scheduling using round robin [9,10]. A variety of scheduling algorithm at present, some algorithms for scheduling, the algorithm is applied to the process of scheduling; but there are also some scheduling algorithm can be used for scheduling, can also be used for process scheduling.

Evolutionary algorithm is based on Darwin's theory of evolution thought as the foundation, through the problem solving to simulate the evolution process and mechanism of the artificial intelligence technology selforganizing, adaptive [11]. Biological evolution is realized through reproduction, mutation, competition and choice; and the evolutionary algorithm mainly through selection, recombination and mutation of these three operations are implemented for solving optimization problems [12].

Genetic algorithm (GA) is inspired by the Holland in 1975 from biological evolution theory and put forward, parallelism and global searching are two of the most significant features of GA [13]. The task scheduling problem under the cloud computing environment, a genetic algorithm for task scheduling to achieve better results. According to Map/Reduce model, and in order to get the total task execution time and task average execution time of task scheduling results are shorter, this paper made some improvements on the genetic algorithm, adds a fitness, two fitness to selected populations, namely double fitness genetic algorithm (DFGA).

4.1 Chromosome encoding and decoding

There are so many ways in chromosome coding, namely, the direct coding, in which the task execution status code is directly used, and the indirect encoding, which is using resources-task indirect coding method [14,15]. The number of chromosome of length of sub tasks, each gene in the chromosome value corresponding to the position number of sub tasks to resources on the resource number.

Consuming that there are T tasks, and W resources, the t^{th} task is divided into N sub tasks, the number of which is $taskN(t)$, thus the total number of sub tasks ($subTN$) will

be:

$$subTN = \sum_{i=1}^{T} taskN(t) \tag{1}$$

For example, 3 tasks need processing with 3 worker resources, and each task has been divided into several subtasks. Task 1 is divided into subtask11, subtask12; Task 2 is divided into subtask21, subtask22, subtask23; Task 3 is divided into subtask31, subtask32, subtask33, subtask34, subtask35. Thus, there are 10 subtasks in all. Then the number of these subtask, which can be a series by a simple method: followed by the sequence of tasksubtask sequence coding. So serial number of the subtask j in Task i is m:

$$m = \sum_{k=1}^{i-1} taskN(k) + j \tag{2}$$

After that, the chromosome decoding will be taken, that is, the subTN distribution gets on worker. Generate a plurality of sets of subTN sequence resource number. Such as the chromosome decoding:

W1: {3, 8, 9, 10}; W2: {1, 4, 5, 7}; W3: {2, 6}

Through the decoded sequence and ETC (Expected Time to Compute) $[i, j]$ said the i subTN execution completed by the use of time in the j resources, which can be calculated for each resource all the sub tasks and the resources on the implementation of the time, the total time to complete all the tasks for the function:

$$F_1(x) = \max_{w=1}^{W} \sum_{i=1}^{n} \text{worker}(w, i) \tag{3}$$

Through the decoding sequence and ETC matrix, the finish time of task t can be calculated from the equation below:

$$taskTime(t) = \max_{i=1}^{taskN(t)} \sum_{j=1}^{k} W(j, i) \tag{4}$$

Thus, the average time of the task will be:

$$F_2(x) = \frac{\sum_{i=1}^{T} taskTime(t)}{T} \tag{5}$$

4.2 Generation of initial population

If the population size is S, the total number of sub tasks is M, and the number of resources, which is also the number of workers, is W, then the initialization can be described as follow: randomly generated by the system of S chromosome, chromosome length is M, the range for the genes can be $[1, W]$, in which value is taken at random.

4.3 The fitness function

Genetic algorithm is a fitness function is used to select the evolution of next generation, and to find the optimal solution of the problem. It is very important to select, related to the algorithm convergence speed and solution quality.

In task scheduling an important goal is: the total task completion time is short. But the task of average used time cannot be ignored, the average time taken to task after consideration, is conducive to the convergence speed of the algorithm are improved, but also to find the optimal necessary, that is: not only the total task completion time is short, and the task of the short time on average. So the definition of the two fitness function can be:

$$f_1(i) = 1/SCD_i(W_j); 1 \le i \le S, 1 \le j \le W \tag{6}$$

$$f_2(i) = meantime(i) = \frac{\sum_{i=1}^{T} taskTime(t, i)}{T} \tag{7}$$

The formula taskTime(t, i) means the time to complete task j in the individual i. That is to say, if the total time to complete the task and the average used time in individuals is shorter, the greater fitness value will be, the more easily to be chosen.

4.4 Genetic manipulation

Firstly, the selection operation is going to be made, which is a genetic algorithm for the individual adaptability evaluation method, but also the realization of the basic way of good genes spread group [16]. The selection operator in DFGA with roulette wheel selection mode, through the two fitness function, the equation (5) and (6), the probability of each individual of the population to be chosen can be calculated with such selection. The probability can be calculated as below:

$$P_1(i) = \frac{f_1(i)}{\sum_{j=1}^{S} f_1(j)} \tag{8}$$

$$P_2(i) = \frac{f_2(i)}{\sum_{j=1}^{S} f_2(j)} \tag{9}$$

The choice of individual generation, first with probability c_1 and c_2 are P_1 and P_2 (under the condition that, $0 < c_1 < 1$, and $c_1 + c_2 = 1$), select one as the selection probability of individual. Through this selection, population in the total task completion time is short of the individual, and the average task in shorter time with individual, provide a genetic basis for the evolution of excellent individual is good enough to be the next generation.

Thus, the total probability of selection under the condition mentioned above will be:

$$P_{i,j} = \max\{P_1(i), P_2(j)\} \tag{10}$$

After the selection, there is the crossover and mutation operation. The cross is the main search operator in genetic algorithms, it mimics the gene recombination process in nature of sexual reproduction [17], genetic excellent genes to the next generation of the individual, and generates new individuals more excellent gene structure. Variability can expand new search space in the population, with local convergence, and it can keep the population diversity by mutation.

The probability function of the crossover and the mutation are as the two equations respectively:

$$P_c = \begin{cases} k_1(f_{\max} - f')/(f_{\max} - f_{avg}), f' \geq f_{avg} \\ k_{2,} f' < f_{avg} \end{cases}$$

$$P_m = \begin{cases} k_3(f_{\max} - f)/(f_{\max} - f_{avg}), f \geq f_{avg} \\ k_{4,} f < f_{avg} \end{cases}$$

Of which: $f_{\max}$ is the maximum fitness value of the population, f_{avg} means to adapt to each generation group value, f_c to the fitness of the larger of the two individual crossover, mutation of F to individual fitness value. With the fitness function formula (5) and (6) the two fitness calculation P_c, Pm concluded, which selected the final P_c, P_m as the larger.

5 Simulation and analysis of algorithms

Since that a local part of cloud computing can be viewed as a special grid environment, Gridsim will be used to simulate the local environment of a cloud in the following passage. Under the same conditions, by using the adaptive genetic algorithm (AGA) compared with DFGA respectively, different results will be shown to get the comparison consequences.

The initial conditions: the number of workers and tasks were: $W = 50$; $T = 50$; range for each task divided into sub tasks for the number of [20,80]. The algorithm terminates conditions were: 1) to reach the maximum evolution algebra gnMax (where gnMax $= 200$); 2) if the 50 consecutive generation of total average completion time did not change the completion time and task, think the basic convergence algorithm, the algorithm is terminated.

Table 1: The main parameters of the two algorithms

Algorithm	AGA	DFGA
Population scale	100	100
Items	k_1, k_2,k_3,k_4	k_1, k_2,k_3,k_4,c_1,c_2
Value taken	0.4,0.8,0.1,0.2	0.4,0.8,0.1,0.2,0.7,0.3

From the two tables and the two figures below, the difference between completion time used respectively by the two algorithms can be seen. Although in the initial stage of evolution, the total task completion time by AGA is less than that obtained by DFGA, but things are different in the average completion time. Then with the further evolution, because of the early only pay attention to the total task completion time, it turns out to resulting in the loss of some potential genes by AGA, into local convergence, while the DFGA with evolution, not only the average completion time is less than AGA, and completed the time is less than AGA in the total task finishing time; and in the middle of evolution, complete the general task for the AGA and DFGA come to the time of similar circumstances, the average completion time of DFGA is significantly less than that of AGA.

Table 2: The total completion time

DFGA		AGA	
Evolution algebra	Completion time/s	Evolution algebra	Completion time/s
20	31.5	20	31.3
40	31.3	40	31.0
60	31.1	60	29.8
80	29.0	80	29.6
100	29.0	100	29.5
120	29.0	120	29.5
140	29.0	140	29.5
160	29.0	160	29.5
180	29.0	180	29.5
200	28.5	200	29.5

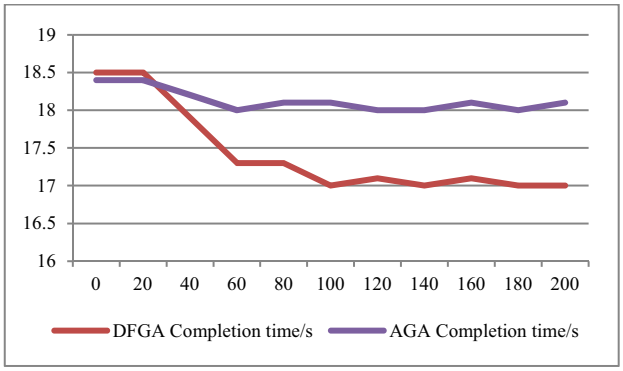

Fig. 6: The total time comparison.

6 Conclusion

In recent years, cloud computing has become the IT industry and information industry a hot topic, as a new generation of development following the distributed

Table 3: The average completion time

DFGA		AGA	
Evolution algebra	Completion time/s	Evolution algebra	Completion time/s
20	18.5	20	18.4
40	17.9	40	18.2
60	17.3	60	18.0
80	17.3	80	18.1
100	17.0	100	18.1
120	17.1	120	18.0
140	17.0	140	18.0
160	17.1	160	18.1
180	17.0	180	18.0
200	17.0	200	18.1

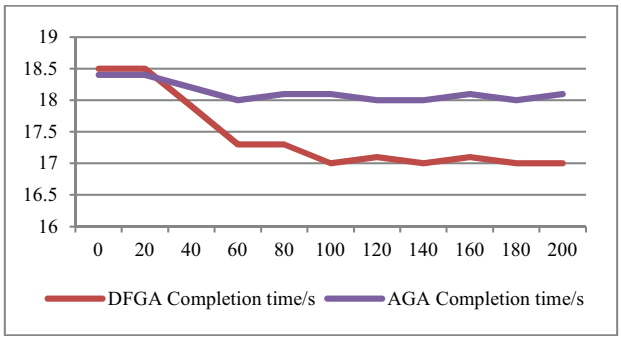

Fig. 7: The average time comparison.

processing, parallel computing and grid computing after the calculation model, it will produce a profound influence on people's future life and work. In essence, cloud computing can be considered as an integration product of distributed computing, parallel computing, utility computing, network storage, virtual product development, load balance and other traditional computer and network technologies. As an academic hotspot, cloud computing has many definitions, but no matter which kind of definition, the task processing model and algorithm of cloud computing as a key research. This paper presents a dual adaptive task scheduling algorithm based on genetic algorithm, this algorithm not only the total task completion time as an important criterion, but also the average completion time as a direct reference volume. The algorithm can be on cloud computing the programming environment to achieve the task scheduling is an ideal, so it is a kind of effective task scheduling algorithm.

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