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# Research on Computer System Architecture for Artificial Intelligence

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***Abstract:***

A network storage resource allocation method based on genetic simulated annealing algorithm is proposed in this article, and it is applied for data storage and backup among heterogeneous systems, as well as the optimal allocation of mobile Agent dispatching sequence in storage process. This method takes into account the timing, priority and storage availability of each mobile Agent and makes the allocation of resources more reasonable on the premise of ensuring the effective execution of each mobile Agent. At the same time, SA is introduced to perform local fine search in GA, maintaining the diversity of the group and avoiding precocious convergence. Simulation experiments show that the mobile Agent storage resource allocation method based on GASA algorithm can not only improve the storage efficiency, but also improve the network real-time and storage performance.

***Keywords****: Artificial intelligence,Computer,system Architecture*

## I. INTRODUCTION

At present, the five major goals of computing technology have been developed rapidly in all fields of human society (Ghahramani Z.2015) [1]. With the advent of the digital era, all kinds of digital appliances and production equipment have been transformed from traditional mechanical control into simple special computer systems. These products and equipment have a certain capacity of computing and processing, which lays a solid foundation for the coming integration of human and computing systems (Gil Y.2015) [2]. Modern people can't do without the Internet, and even some people rely on the Internet for information access and communication every minute. Thus, Internet has become an important living tool in modern human society and a living platform for sharing resources (Chen I R et al.2015) [3]. With the continuous emergence of new Internet technologies, the Internet will further expand the coverage and improve the transmission speed to realize the new model of computing technology from isolated and closed state to more open and interconnected ( Davis E et al.2015) [4]. It is found that only an intelligent computer system can be used to do more work instead of human beings with the introduction of intelligent concepts such as smart homes, intelligent transportation, and the Internet of things in recent years (Broda M et al.2015) [5]. Agent is an important tool to liberate human beings. And the control decision-making power can be completely handed over to the computer system by the concept of agent. It can be said that the agent is the embodiment of the transformation of human intelligence to Computational Intelligence (Qadir J.2015) [6].

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The form of contemporary computing technology has gradually developed to reflect the way and concept of human understanding of the world. So the more advanced abstract patterns and the more humanized applications will be the inevitable trend of future computer language implementation（Gu M et al.2017) [7].

## II. MATERIALS AND METHODS

### 2.1 STATE OF THE ART

Task allocation theory is a computational abstraction that highly generalizes the expression and pattern framework of the assignment problem of special tasks, which is the result of the development of the solution of the assignment problem of special tasks in various fields. Therefore, we can divide the research progress of task allocation theory into the following phases according to the time sequence. When it comes to the establishment of the classical task allocation theory, the development and application of operational research promoted the establishment of the classical task allocation theory in 1940s（Gonzalez L F et al.2016) [8]. Operation research is mainly to solve the problem of optimizing the work task by using the existing resources and capacity conditions. The application of operational research is to abstract the task allocation problem between resources and tasks through the production management process and the organization operation mode in real life, and then establish the linear programming model and assignment model （Zhao K et al.2016) [9]. It can be said that operations research opens the school of research on the theory of the assignment of classic tasks. The main results of this period are as follows: first, the classical linear programming problem model and the simplex method for fast solving are proposed. Second, the assignment problem is modeled and the effective Hungarian algorithm is designed. Third, the integer programming problem model is constructed and the reliable branch and bound method is studied. The initial research on the problem of production scheduling should be traced back to 1950s. At that time, some scholars studied the flow shop scheduling problem of two machines. In the next more than 50 years, the problem of production scheduling has been a hot topic for many scholars. As a complex combination optimization problem, production scheduling problem has been proved to be a NP-hard problem. The research status of production scheduling problem is mainly divided into two aspects, namely the research status of the classical algorithm of production scheduling problem and the research status of multi Agent production scheduling system（Amin R et al.2017) [10].

### 2.2 Model framework

ICNPIDS is composed of data acquisition Agent (DCA), immune detection Agent (MDA), Agent (AA) and management Agent(MA). The architecture of the system is shown in Figure 1.

DCA is a resource requesting party, which is mainly responsible for collecting network data flow, and carries out data package analysis and feature extraction and statistical work. Because ICNPIDS takes a miscellaneous collection of Ethernet cards, DCA gets all the feature data through this network by the WINPCAP packet capture library and submits it to MDA. MDA is a resource that needs to be registered to use. MDA is responsible for generating immune detection antibodies that can detect network intrusion, and

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use these antibodies to detect network packets and distinguish the attack packets. Each MDA resides in three kinds of immunization antibodies: PAb, MANAb and FANAb. The structure of MDA is shown in Figure 2.

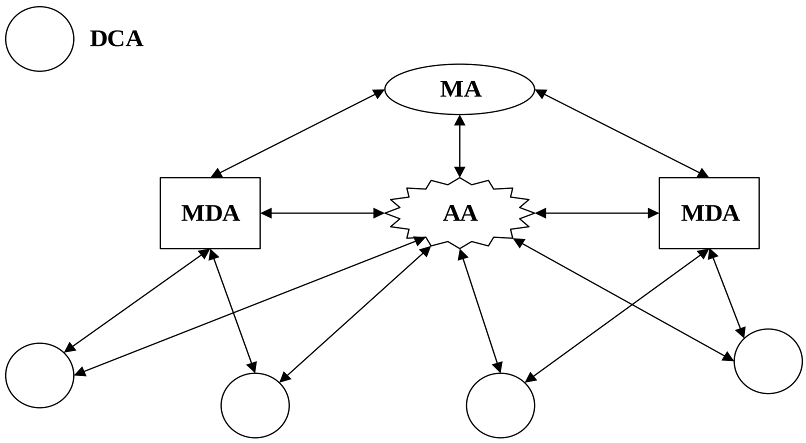


Figure1:Architecture diagram of the model

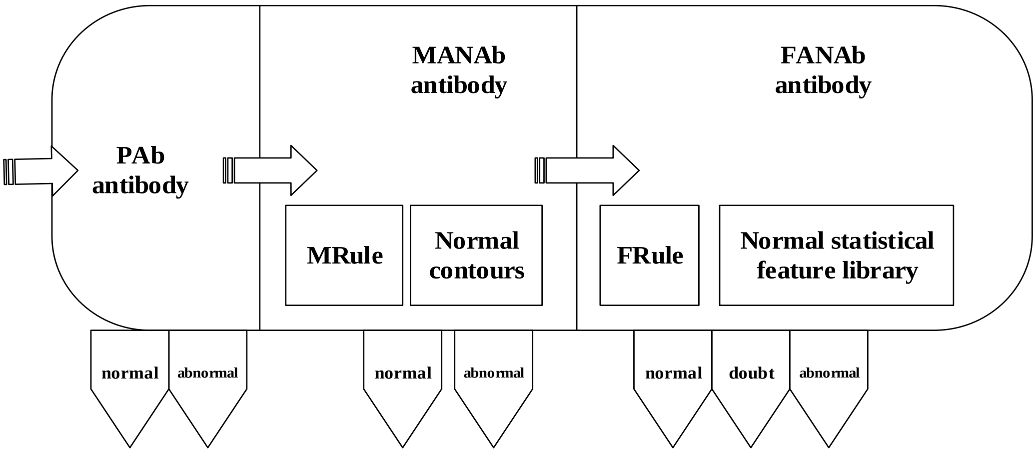


Figure 2: structure of MDA

AA as an intermediary of resource requestor and resource, its goal is to effectively utilize the detection service provided by MDA to complete the DCA attack detection request and realize the reasonable scheduling of resources. AA maintains an unallocated DCA registry and an available MDA registry. AA sends the TZData of the assigned DCA to the appropriate MDA for data processing according to a certain scheduling policy after receiving the assignment instruction. MA monitors intrusion interfaces for users with accurate alarm information, displays alerts sent from MDA, and controls the start or stop of other Agent manually.

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### 2.3 Allocation algorithm

First, AA is an important part of multi Agent intrusion detection system for the task allocation policy based on resource availability. The load balancing capability of the whole system is regulated by AA. The main task of the AA is to collect the pre processed TZData for each DCA and assign the TZData to the appropriate MDA according to the current load situation and selection strategy of each MDA. An improved scheduling strategy for resource availability is proposed according to the actual situation of the system. In the system, whether a pending TZData is assigned to a MDA is determined by the performance synthesis index on MDA, and also includes the detection accuracy A and the resource efficiency E. Therefore,

$$U_i = A_i \times E_i \quad (1)$$

Among them, $U_i$ is the resource availability of the MDA i, $A_i$ is the detection accuracy of the MDA i, and $E_i$ is the efficiency of the MDA i.

$$A_i = AlarmRate(x)_i \times w_i + MisreportRate(x) \times w_2 \quad (2)$$

AlarmRate (x) is the alarm rate of the MDA i at the x moment, MisreportRate (x) is the false alarm rate of the MDA i at the x moment, and $w_1, w_2$ is the weight coefficient here.

$$E_i = \frac{Mum_{worked}(y)}{Num_{wordek}(y) + Num_{deplyed}(y)} \quad (3)$$

$Num_{worked}(y)$ is the number of TZData for the MDA i at the Y moment. $Num_{deployed}(y)$ is the number of TZData for the MDA i at the y moment. AA calculates the availability of resources for each MDA according to the above resource availability calculation method, and determines the allocation of the pending TZData.

Then we define that if the antibody is isolated from each other （it acts independently and does not interfere in the process of identifying itself and in the process of non self.)and has a certain isolation and singleness, then it is called the monomer of the antibody. For ultra complex intrusion attacks, a single MDA detection experience is not fully detected, which is caused by the monomer of the antibody. Therefore, AA can not assign an ultra complex intrusion detection task to a single MDA by the allocation strategy. In order to overcome the limitation of antibody specificity, we can share and learn the experience between MDA by coordinating the detection behavior between MDA, so as to achieve effective allocation of super complex intrusion detection tasks. Based on the above idea, we have proposed a new immune antibody, combined immunization antibody (UAb). The main UAb antibody was to detect some "suspected" TZData relative to the results of FANAb antibody detection. Aiming at the above TZData, it can instantly set up the "analysis experience" associated with MDA, and finally determine whether there is an invasion attack based on the

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joint immune detection function Y. And Y has two states: normal and abnormal. The UAb antibody is composed of the UAb anomaly detection rule set URules and the UAb relational library. URules is mainly collected for the joint immune detection of MRule, which used to store important computing data for joint immune detection and the attribute information of related MDA. The structure of UAb in MDA is shown in Figure 3.

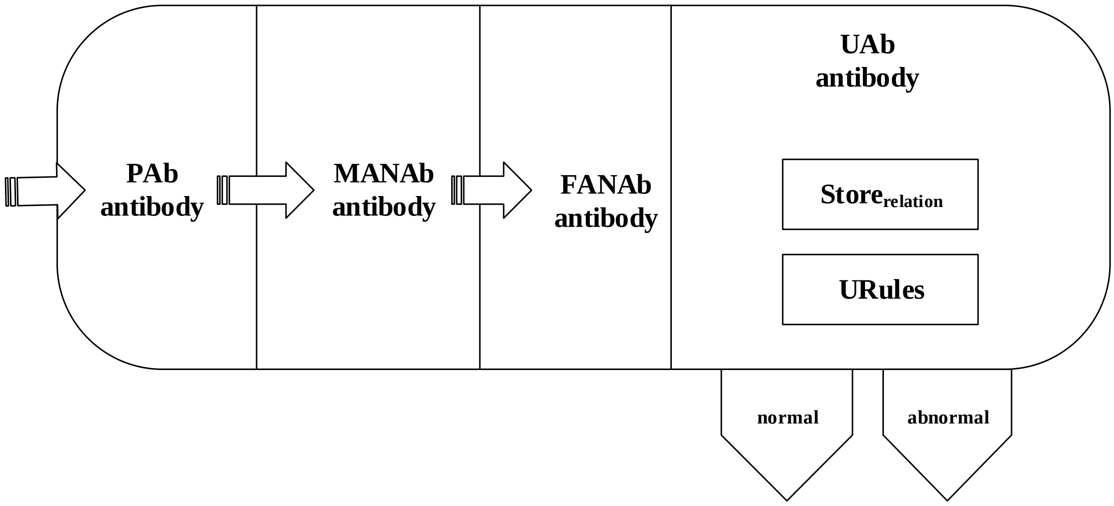


Figure 3: The structure of UAb in MDA

For every MDA, it needs to maintain a joint immunization task queue TaslQueue, and store several TZData which is suspected by FANAb antibody test. We divide all MDA into three categories: management MDA, bid MDA, and middle bid MDA based on the classification of contract network protocols. The definition management MDA believes that the degree of FANAb antibody intrusion detection results in the bid MDA is called the degree of trust, recorded as $Tr(i), Tr(i) \in [0,1], i \in [1,n], n \subseteq N, n$ is the number of MDA. In StepA4, bid MDA MANAb test results to the management MDA transmission format "MDA (I) |MANAb |nonliability/ abnormity| MRule (I)" bids, namely "MANAb immune tenders"; FANAb MDA sent to the management format "MDA (I) | FANAb|D (I) |Tr (I) |FRule" the tender, namely "FANAb type immune tenders". MRule (I) represents an anomaly detection rule that triggers MANAb antibody to make nonliability /abnormity (normal / abnormal) results in MDA (I). It represents a fuzzy anomaly detection rule involved in FANAb antibody calculation of immune suspicion. When the immune skepticism D (I) is calculated by FANAb antibody, the fuzzy implication operator uses the minimum operation:

$$A \to B = \min(\mu_A(x), \mu_B(x)) \quad (4)$$

Fuzzy synthetic operators are fuzzy and operation:

$$\mu_{A \cup B}(x) = \max(\mu_A(x), \mu_B(x)) \quad (5)$$

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For StepA5, management MDA will select a specific bid MDA based on the joint immune decision function F as the winning bidder Agent, and the specific algorithm of the function F is as follows: After managing the bidding documents of MDA, the management of MDA will first select the specific bid MDA by the joint immune decision function F as the winning bid MDA, and add a data item FLAG to the bid document to identify it. If the MANAb type is identified with the FLAG1 documents; if the bid for FANAb is tender, identified with the FLAG2; to form MDA (I) MANAb | | nonliability /abnormity |MRule (I) |FLAG1 or MDA (I) |FANAb|D (I) |Tr (I) |FRule (I) |FLAG2 "standard book; It will then create a space for storing the UAb exception detection rule set and the UAb relational library $Store_{\mathrm{relation}}$ . Then received the bid in the bid of MRule (I) and FRule (I) in the URules; finally, it will be "MDA other data items mapped into the tender (I) - MANAb - nonliability /abnormity" or "MDA (I) - FANAb - D (I), Tr (I)" relationship, and stored in $Store_{\mathrm{relation}}$ .. At this point, the UAb antibody has been completed in the management of MDA.

Since the generated UAb antibody needs to process more than one MDA's tenderer information for a certain period of time, the memory resources occupied at the moment are quite large. Therefore, its existence can only be temporary; it will release the corresponding memory resources in a short time to improve the efficiency of the whole system. So each UAb antibody came into being with the arrival of a new type of invasion attack and disappeared with the first detection of this intrusion. For the results of each UAb antibody test, it will be used as an empirical knowledge to transfer to the PAb and MANAb antibodies that solidify into the associated MDA. That is to say, if the same invasion attack occurs later, it will be detected by local PAb and MANAb antibodies. The specific detection and update process is as follows: in StepC2, for each MDA trust degree Tr (I) calculation, we believe that MDA's trust comes mainly from the long time SA's research on MDA execution history, so MDA trust degree Tr (I) is:

$$Tr(i) = \frac{size_i}{T} \quad (6)$$

$size_i$ is used to handle the TZData size (byte) in a fixed time. T is a fixed time. The immune detection algorithm proposed in this paper has the following steps as follows: On the one hand, the algorithm eliminates the detector tolerance test in negative selection algorithm, and avoids the disadvantage that a large number of network packets make the generated immune antibody take too long. On the other hand, the boundary of normal overload and abnormal overload is fuzzy, so the results of FANAb antibody detection include three states: normal, suspicious and abnormal. In reality, most of the results of FANAb antibody detection are "skeptical". There are a lot of intricate intrusions and attacks on these data, but only because the "analysis experience" of local MDA is not enough. Therefore, the UAb antibody detection method has been added to the system, which has promoted the experience from each other in MDA, realized the effective allocation of the complex intrusion detection tasks and improved the intelligence of the system and early warning for complex problems.

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## 2.4 Experiment

In order to verify the storage efficiency of the model, we focus on comparing the effects of the C/S model and the mobile Agent model on the IO frequency and delay. In the process of data transmission and data storage in the simulated network storage, the curves of IO frequent degree and delay change with time under the same simulation parameters are shown in Figures 4 and 5.

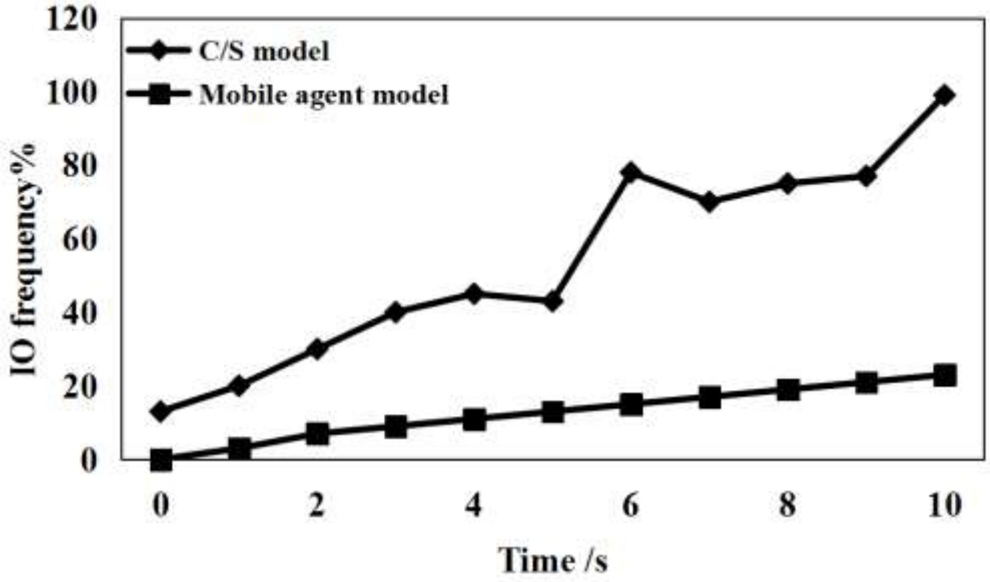


Figure.4 Comparison of the IO frequency of the C/S model and the mobile Agent model

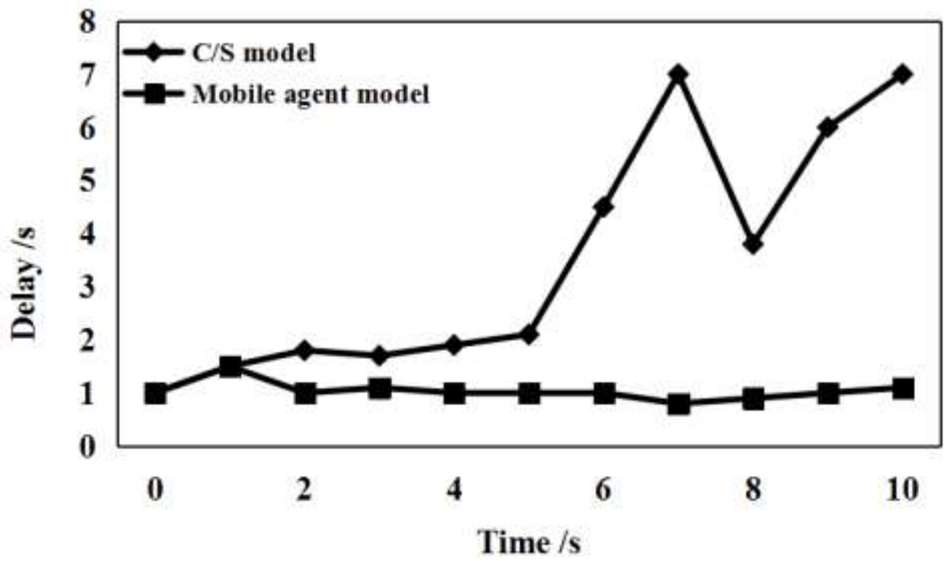


Figure.5 Time delay comparison between C/S model and mobile Agent model

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Throughout the curve development trend of Figure 4, the IO frequency of C/S model increases linearly with time compared with the mobile Agent model. From the vertical time perspective, the IO frequent degree of C/S model is about 3 to 4 times higher than that of mobile Agent model at the same time point. The main reason is that in the C/S model, the backup server Agent has large transmission data, serious network congestion and increased the retransmission times, which increases the IO frequency and reduces the storage performance of the network. As we can see from Figure 5, the delay of the C/S model is basically oscillating up with time, while the delay of the mobile Agent model is relatively stable and much slower. As a result, the mobile Agent model has the advantages of small network transmission, reasonable communication planning and so on. Therefore, the resource allocation model based on mobile Agent model is more suitable for network storage applications, such as strong real-time monitoring, large data transmission and efficient storage backup.

### 2.5 Experiment

In order to verify the effectiveness of the algorithm, the sequential allocation method, GA allocation method and GASA allocation method are used to plan the allocation order of mobile Agent as network storage resources, and the influence of mobile Agent storage resource allocation method on network storage performance is analyzed. The three different allocation methods are based on the premise that all tasks are completed, and the task response rate of GASA allocation method is higher than that of the other two, but the 10 frequent degree and CPU occupancy rate are very low through the correlation data between GASA and GA. Meanwhile, in order to compare the changes and causes of storage performance of different algorithms in operation, we extract the performance index of IO frequent and delay separately, and do separate quantitative analysis, as shown in Figure 6.

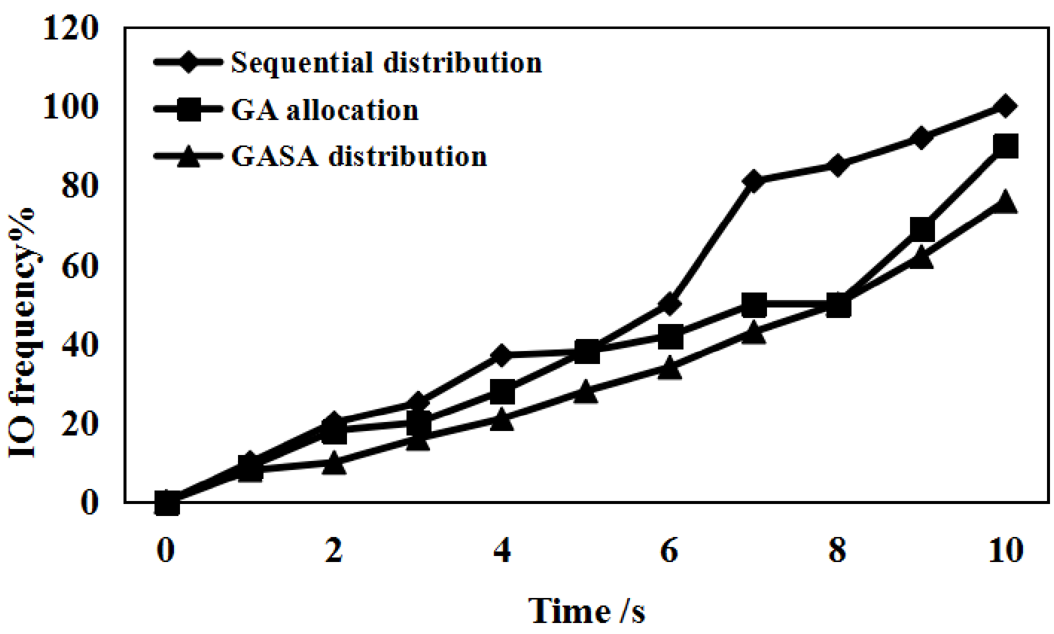


Figure 6 : Comparison of 10 frequencies of three algorithms

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From a global perspective, we can see Figure 6. When mobile Agent is allocated, the IO frequent degree of network storage increases irregularly and linearly with time under three different allocation methods. But from a longitudinal perspective, at the same time point, the IO frequency of the GASA allocation method is the lowest, the IO frequency of the sequential allocation method is the highest, and the IO frequent degree of the GA allocation method is between the two. It shows that: first, the optimized GASA allocation method can effectively plan the sending order of mobile Agent, and effectively reduce the IO frequent degree, and further improve the network storage performance. Second, the global optimization ability of the GASA allocation method is much better than the GA allocation method. Therefore, the resource allocation model based on the GASA allocation method can enable network storage to have better performance. Figure 4.15 shows the time delay of each mobile Agent under three different allocation methods. Compared with the sequential allocation method with sharp fluctuation in distribution delay and the GA allocation method with relatively slow change, the GASA allocation method has a very significant optimization effect in the time limit of task completion, network storage effect and reliability. It shows that: first, the mobile Agent dispatching mechanism based on the GASA allocation method can reasonably arrange the allocation order and effectively balance the delay time of mobile Agent, so as to ensure the efficient and stable implementation of the network storage backup process. Second, due to the optimized GASA allocation method, the time delay of the mobile Agent is lower. Therefore, the GASA allocation method has better robustness and optimization effect than the GA allocation method and the sequential allocation method.

## III. CONCLUSION

In recent years, many researchers at home and abroad have proposed a series of collaborative mechanisms and intelligent algorithms for simulating some phenomena in nature, market economy and social system. Compared with traditional solutions, these techniques usually have better diversity, adaptability and reliability. MAS is one of the best distributed solutions for the current scheduling problem. It provides a good platform and environment for the implementation of the above cooperative technology and intelligent algorithm, and has a very broad application prospect. It has certain theoretical significance and practical application value for the research of CNP collaboration mechanism, GPGP cooperation mechanism and the improvement and mixing of related intelligent algorithms, as well as the specific application in the field of distribution scheduling. A network storage resource allocation method based on GASA algorithm is proposed in this article to solve the problem of network storage resource allocation. This method takes into account the timing, priority and storage availability of each mobile Agent and makes the Agent dispatch order more reasonable, the allocation effect more significant, the storage performance more perfect on the premise of ensuring the effective execution of each mobile Agent. At the same time, SA is introduced to perform local fine search in GA, maintaining the diversity of the group and avoiding precocious convergence. It makes the Agent dispatch order more reasonable, the allocation effect is more significant, the storage performance is more perfect.

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