Research on the Application of Computer Cloud Computing Technology in Laboratory Management Based on Docker Platform

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Abstract. The balance of experimental resources needs the help of distributed resource scheduling algorithm to integrate the discrete resources logically, and plan the scheduling and application uniformly, so as to ameliorate the utilization efficiency of resources, which provides a broad space for the application of Docker tech. Based on this, this paper first analyses the concept and connotation of Docker container platform, then studies the construction of laboratory cloud platform based on Docker platform, and finally gives the utilization effect of laboratory management cloud platform based on Docker tech.

Keywords: Cloud Computing, Laboratory Management, Docker Platform

1. Introduction

With the iterative progress and growth of computer tech, it has been widely and deeply studied and applied in many fields, especially in laboratory management, which incalculable ameliorates the level of laboratory management. On the other hand, as a typical open source utilization container engine and virtualization tech, Docker is based on Linux container tech, including several aspects as shown in Figure 1. With the help of Docker container to maintain the consistency of the running environment, continuous delivery and deployment can be carried out. As a relatively new concept, cloud computing not only subverts the service mode of IT system, but also innovatively subverts the utilization mode of info network and computer [1]. On the one hand, with the help of cloud computing, the flexibility and scalability of distributed computing are further strengthened, and its use cost is also significantly reduced.

As a kind of computing resource of physical infrastructure, cloud computing provides users with scalable services according to their needs, and dynamically manages a variety of resources. In order to ensure that cloud computing providers can provide continuous and stable computer services, it is necessary to establish a scientific and effective resource scheduling mechanism to ameliorate the resource utilization efficiency, resource allocation and scheduling reliability of container cluster.
Using Docker container cluster resource allocation algorithm can effectively allocate, manage and schedule resources. Docker container is fast and lightweight, which can set up heterogeneous utilizations in the cluster, monitor the nodes and container resources in the cluster in real time, and schedule the resources of the container cluster.

In addition, due to the laboratory in the actual operation process, its resource load will be affected by random use and there is certain volatility. In order to ensure the balanced use of resources to avoid waste, we need to use the distributed resource scheduling algorithm to integrate the discrete resources logically, and make unified planning, scheduling and utilization, so as to incalculable ameliorate the utilization efficiency of resources [2]. It can be seen that cloud computer tech can realize the optimization and integration of material resources without changing the resource architecture, and enhance the independent state of the resource entity structure. The use of Docker platform can further ameliorate the differentiation of the environment, the complexity of the configuration process and the high granularity of resource scheduling, so as to better meet the actual needs of laboratory management.

In a word, the packaging tech of Docker container is rapidly and batch packaged and deployed to the laboratory management environment. Micro-service tech further ameliorates the functionality of the container cloud platform represented by Docker, and makes it conform to the relevant specifications of micro-service cloud platform management scenarios [3]. Docker platform can effectively divide the resources managed by a single operating system into isolated groups, so as to better balance the conflicting resource use requirements among isolated groups. With the help of distributed utilizations, the efficient utilization, migration and expansion of laboratory resources in cloud platform are realized. Therefore, it is of incalculable practical value to study the utilization of computer cloud computing tech based on Docker platform in laboratory management.

![Figure 1. Contents of Docker tech platform](image)

2. The concept and connotation of Docker container platform

2.1. The concept of Docker container platform
Docker is a lightweight virtualization solution based on container tech. Docker is a container engine. It encapsulates and abstracts C Group, namespace and other container underlying technologies of Linux, and provides users with a convenient interface for creating and managing containers. As an open source project, Docker is implemented based on go language launched by Google [4]. Microsoft, red hat, Linux, IBM, Oracle and other mainstream IT manufacturers have increased their support for Docker in their products. Google launches more than 2 billion containers every week for business services, and has begun to use container tech on a large scale.

2.2. Functions of Docker container platform
The main functions of Docker container platform are content independence, hardware independence, hardware independence, automation, efficiency and responsibility separation. In the aspect of content independence, any payload and its dependencies can be encapsulated. In the aspect of hardware
independence, Docker can run on almost any platform using operating system primitives—virtual machine, Open-stack, public IAAs, etc., without modification [5]. In addition, at the level of content isolation and interaction, Docker tech can isolate resources, network and content and avoid dependence. In terms of automation features, there are standard operations for running, starting, stopping, submitting and searching under Docker platform, which is very suitable for CI, CD, automatic expansion and hybrid cloud. In the aspect of efficiency features, Docker, as a lightweight platform, can move and operate rapidly. Finally, at the level of responsibility separation, the developers and operators under Docker platform are responsible for different directions, with clear responsibilities and clear division of work.

From a technical point of view, the traditional container only solves the container run problem, while Docker defines a set of container build, ship and run problems, as shown in Figure 2 below.

![Figure 2. Functions of Docker container platform](image)

2.3. Utilization advantages of Docker container platform
As a lightweight way of virtualization, Docker has the advantages of fast running speed, less resource requirements and convenient operation compared with the traditional virtual machine [6]. Among them, the Docker container is very fast, and the start and stop can be realized in seconds, which is much faster than the traditional virtual machine mode. There is little demand for system resources, and a host can run thousands of Docker containers at the same time. In addition, it is convenient for users to obtain, distribute and update utilization images through Git like operations, with concise instructions and low learning cost. Docker supports flexible automatic creation and deployment mechanism through Docker file configuration file to ameliorate work efficiency. In addition to running its utilizations, Docker container does not consume additional system resources to ensure utilization performance and minimize system overhead.

3. Construction of laboratory cloud platform based on Docker platform

3.1. Cloud computing tech in laboratory cloud platform
Cloud computing is a scalable and flexible computing method based on it support capability, which provides services to users in the form of services through network tech. Cloud computing tech in laboratory management has the typical characteristics of network centric, service-oriented, high expansion reliability, resource pooling and transparency [7]. The utilization of cloud computing tech in laboratory management can realize the transformation of laboratory info assets from hardware to software, from software to service, from decentralized service to centralized service. The architecture of laboratory cloud management platform mainly includes unified and integrated interface view, unified and integrated service management, unified and integrated laboratory data management and unified and integrated laboratory asset management.
3.2. Laboratory management based on Docker tech
The development and deployment of laboratory management based on Docker tech can ameliorate the dependence of network and server, control the cost of laboratory construction, and ameliorate the operation efficiency of laboratory platform. The cloud server cluster is responsible for the control and computing performance of the cloud platform, and achieves access with the help of network switches and utilization servers [8]. At the same time, the switches in different spaces of the laboratory are upgraded to achieve high-speed network coverage, so as to ensure the internal transmission bandwidth of the laboratory. In addition, the deployment of cost-effective terminals in the laboratory ensures the storage and computing capabilities of the laboratory cloud computing platform, and ameliorates the flexibility of the laboratory teaching conditions.

3.3. Laboratory cloud platform management function based on Docker tech
Based on Docker tech, laboratory cloud management platform has the functions of virtual machine management, equipment and timing management, authority management, cluster load balancing, high availability management and centralized backup platform. Among them, at the level of virtual machine management, the laboratory administrator can operate the virtual machine more flexibly [9]. At the level of equipment and timing management, the business server of data center can be restarted regularly. At the level of authority management, different laboratory managers can be authorized. At the level of supporting cluster load balancing, it can allocate computing resources and ensure resource balancing. In addition, in the aspect of high availability management, high-performance platform network switches can be allocated organically to realize centralized backup management.

4. Utilization of laboratory management cloud platform based on Docker tech

4.1. Utilization of Docker tech in laboratory management cloud platform
The utilization of Docker tech in the laboratory management cloud platform can automatically package and deploy laboratory utilizations. Docker relies on complete encapsulation for utilizations. The same image can be deployed repeatedly in testing, integration, production and other environments. It is suitable for continuous integration and continuous deployment process [10]. Secondly, it can create a lightweight, private laboratory PAAS environment; carry out automated testing and continuous integration and deployment. The laboratory development and deployment process based on Docker is shown in Figure 3 below.

![Figure 3. Process design of laboratory deployment based on Docker](image)

4.2. Utilization effect of laboratory management cloud platform based on Docker tech
The deployment process of laboratory development and testing based on Docker simplifies the steps of building laboratory environment, ameliorates the utilization efficiency of laboratory resources and the speed of development and testing deployment, and reduces the cost of migration. Second, with Docker, laboratory managers can quickly build a standard experimental development environment by using the
image; after the development is completed, the experimental testing and operation and maintenance personnel can directly use the same environment to deploy code. In addition, Docker can realize fast iteration and save a lot of development and deployment time. Moreover, each step has a clear configuration and operation, the laboratory operation and maintenance personnel need to use the software with good visual management ability, and has feasible monitoring means.

5. Conclusion
In summary, Docker platform can balance the conflicting resource requirements among isolated groups, and realize the efficient utilization, migration and expansion of laboratory resources in cloud platform with the help of distributed utilizations. This paper analyzes the utilization advantages of Docker container platform by studying the concept and connotation of Docker container platform. Through the analysis of the construction of the laboratory cloud platform based on Docker platform, this paper studies the laboratory management based on Docker tech and the utilization effect of the laboratory management cloud platform based on Docker tech.

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