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Retraction

Retracted: Laboratory Virtualization Management Based on Deep Integration of Cloud Desktop

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] Y. Liu, S. Duan, and B. Wang, "Laboratory Virtualization Management Based on Deep Integration of Cloud Desktop," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 4487023, 7 pages, 2022.

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Research Article

Laboratory Virtualization Management Based on Deep Integration of Cloud Desktop

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In order to solve the problems faced in the process of laboratory construction and management, the author proposes a complete laboratory cloud desktop virtualization management platform. The platform combines the school's existing experimental teaching environment and teaching mode, through actual deployment and online monitoring; it is further verified that the cloud desktop platform not only provides personalized desktop services but also realizes unified management of resources. Experimental results show that the system function tests are all in line with expectations; during the network bandwidth test, the thin client protocol machine is used to access the cloud platform, and the Thunder player is opened to play the movie application, and then, the thin client machine uses RDP to access the cloud platform; when RDP is playing a movie, the traffic is mainly in the range of 1.2~1.6 Mbps, and the network delay is less than 1.3 s. Through research, it is found that the platform enhances students' learning initiative, improves teaching management level, and has high experimental teaching application value.

1. Introduction

With the continuous improvement of the level of social informatization, as well as the popularization of computer applications, computers have become an indispensable common tool in all walks of life; the ability to operate and use computers has also become one of the necessary skills for contemporary college students. All majors in colleges and universities, whether it is science or literature and history, require students to have the ability to use computers to process and solve problems [1]. To this end, colleges and universities around the world invest a lot of money every year to build, rebuild, and expand computer laboratories, creating good hardware conditions for the cultivation of students' computer practice ability. Cloud desktop is actually a specific application of cloud computing virtualization technology; the biggest difference between it and server virtualization technology is that it focuses on providing customers with virtual desktop services that are not limited by physical venues and physical hosts; compared with traditional PCs, in the case of network connectivity, users can call up their own dedicated virtual desktops at any time in any place such as home, office, and conference room; therefore, it can handle its own work business without interruption, as shown in Figure 1. Cloud desktop first appeared to solve the problem of enterprise mobile office; at present, the actual application scenarios of cloud desktops are not limited to corporate offices but also show good application prospects in the education industry [2]. Cloud desktop technology can also solve the problems of high construction cost of computer laboratory hardware and fast update and elimination. Since cloud computing technology can centrally manage hardware resources and classify them on demand, when it is necessary to improve the configuration of cloud desktops, it is only necessary to upgrade or expand the resources of the cloud server cluster to achieve the purpose of benefiting the old [3].

2. Literature Review

Chen et al. designed and implemented a laboratory management system based on the Internet of Things, which controls the equipment through the network and realizes the

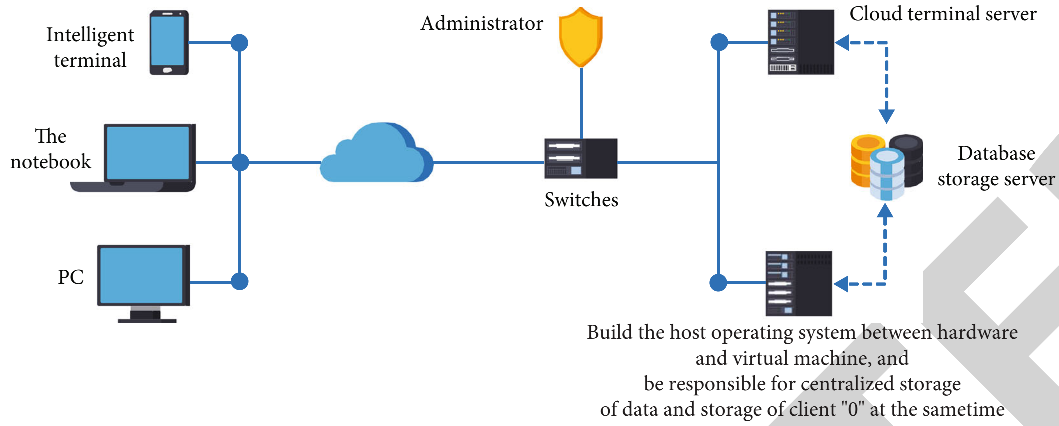

Figure 1: Cloud desktop.

intelligent monitoring of the laboratory [4]. System through wireless nodes (ZigBee module, sensor module, and alarm module) collect data in the laboratory, monitor the temperature, humidity, and other information in the laboratory, adopt automatic alarm mechanism, NFC card reader to verify identity, mobile App to control indoor lighting, etc., realize the automatic management and intelligent monitoring of the laboratory. Applying technologies such as cloud computing, virtualization, and Internet of Things in laboratory management is a new trend in laboratory construction. Build a cloud computing platform and concentrate commercial performance computing resources on the server side; unified management is conducive to the rational allocation of computing resources, improving the quality of computing services. Elshall and others put forward the concept of "smart earth," adding sensors in the fields of transportation, medical treatment, equipment management, etc. and controlling people and things in the system through computer technology [5]. Olaverri-Monreal et al. also used the Internet of Things technology to establish a network perception laboratory and a wireless integrated network sensor laboratory [6]. Du et al. designed the remote experiment function in the cloud, which solved the problem of time and space constraints for on-machine experiments, and the platform runs efficiently and reliably. The existence of the cloud computing platform reduces the computing burden of the client and also gives people new ideas for laboratory construction, that is, provide cloud desktop services, replace the host with a thin client, and "slim down" the client [7]. Zhang et al. conducted research on data-intensive supercomputing and built cloud computer equipment to provide image processing and sharing services, which improved the efficiency of image processing [8]. The author takes building a new generation of smart campus as the long-term goal to carry out the school-level overall education informatization construction; in laboratory teaching, a new generation of information technology such as virtualization and cloud computing is used to create a more advanced environment for teachers' teaching and students' learning, providing unified, open, and shared learning resources for laboratory students through the cloud desktop virtualization platform.

3. Research Methods

3.1. Related Technologies. VDI (virtual desktop infrastructure), virtual desktop infrastructure, also known as centralized computing architecture, is currently the most widely used mainstream cloud desktop virtualization technology [9]. The virtual desktop technology in the VDI mode integrates all client operations, and the server provides the data, software, computing, and other resources required by the user; what the user actually obtains is the remote desktop operating system environment of a virtual machine on the server. Relevant Chinese experts and scholars have also done a lot of research on cloud desktop technology and actively explored the implementation plan of virtualized management of university laboratories [10, 11]. By analyzing the problems faced in the current laboratory construction and management process of the school and closely combining the practical application requirements of the laboratory, the author focuses on the design and implementation process of cloud desktop virtualization technology in laboratory management, in-depth analysis of access control, resource sharing, data security, operation and maintenance, deployment cost, etc.; a complete laboratory cloud desktop virtualization management platform is designed, and the application value of the platform is verified through actual deployment and online monitoring.

3.2. Cloud Desktop Design and Deployment

3.2.1. Design Objectives of Cloud Desktop. The school uses Microsoft RDS virtual desktop technology to improve and manage the laboratory in a centralized manner, and the design is based on the total scale of 800 users and 500 concurrent users in the early stage [12]. The virtual desktop user resource configuration is as follows: 4G memory, 2vCPU, 50 GB system space, 10 GB user data storage space, and resource expansion will be carried out gradually. Under the condition that the management design structure remains unchanged, it will eventually meet the needs of 5,000 people. After the platform is completed, the unified management of the entire laboratory terminal will be realized, the local terminal will only be used for connection use, and the computing tasks will be transferred to the cloud desktop, which can effectively improve the service life of the local terminal, so as to realize the reduction of TCO (total cost of ownership). At the same time, the centralized back-end cloud desktop data center is more conducive to the upgrade, update, and maintenance of the overall architecture, meeting the needs of school information security and improving students' enthusiasm and creativity.

3.2.2. Cloud Desktop Deployment Solution Architecture Design. The design diagram of the laboratory architecture based on the cloud desktop is shown in Figure 2. The overall architecture of cloud desktop includes four layers of modules: network access layer, application delivery layer, virtualization resource layer, and core application layer [13].

Network access layer: users log in to the cloud desktop platform through the access layer component RD Web interface and use SSL encrypted transmission to interact with the data center, including the allocation of cloud desktops, access to virtual applications, and storage of personal data and configuration files. At the same time, the security policy is used to set user rights' grouping, ensuring that users with different permissions have personalized cloud desktop collection login permissions. Application delivery layer: it mainly provides cloud desktop and virtual application services for users. The application delivery layer presents virtualized resources to users in the form of cloud desktops and virtual applications, and all computing operations of users are performed at this layer. At the same time, it is responsible for transmitting the user's personal data and configuration data to the virtualized resource layer, and feeding back the execution result to the current user, it not only ensures the security of user data but also improves the utilization of data center resources [14].

Virtualization resource layer: the virtualized resource layer uses technologies such as server virtualization, storage virtualization, and network virtualization to uniformly and intensively provide hardware resources such as servers, networks, and storage required by various cloud desktop applications; at the same time, it provides an integrated management platform for various virtual desktops, cloud applications, resources, etc. In addition, the virtualization layer also provides some other common basic services and architecture management service components required by the overall architecture. Core application layer: this layer is the carrier platform for the school's existing management systems and teaching systems, such as campus portals, campus cards, and emails; all business systems can run on independent virtualization platforms; these business systems can also be migrated to run on cloud desktop virtualization platforms to improve server utilization [15].

3.2.3. Cloud Desktop Deployment. Cloud desktop deployment mainly includes five modules: hardware deployment, network deployment, storage deployment, system deployment, and component deployment [16].

(1) Hardware Deployment. The entire platform uses 2 H3C UIS tool boxes; each tool box has 16 H3C UIS servers, a total of 32 servers. Create three Hyper-V clusters as the underlying virtualization support platform, including one infrastructure cluster and two virtual desktop hosting clusters. The infrastructure cluster server consists of 2 H3C blades configured with 2-way 2.0 GHz CPU, 256 G memory, and 1 dual-port 20 G converged network card, providing a computing environment for Microsoft RDS infrastructure servers; the running infrastructure includes active directory (active directory), RD connection broker (controller), RD Web (authorized access), RD license (authorization), RD gateway (gateway), file server, database server, and other virtual machine servers. The virtual desktop hosting cluster server consists of 30 H3C blades configured with 2-way 2.0 GHz CPU, 256 G memory, and 1 dual-port 20 G converged network card and hosts a virtual desktop pool with a total scale of 800 users [17].

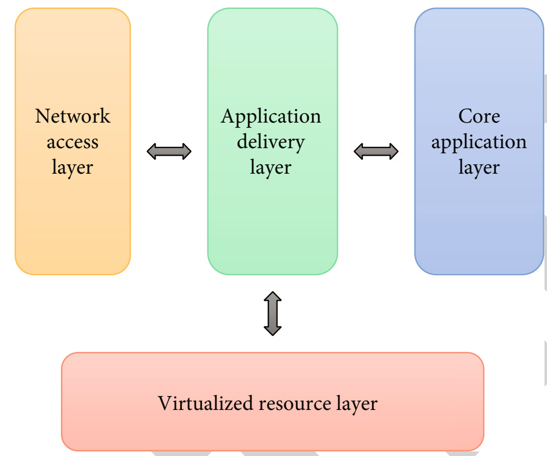

Figure 2: Laboratory cloud desktop architecture design.

The hardware blade server cluster allocation is shown in Table 1.

(2) Network Deployment. The network deployment adopts the principle of separation of three networks; that is, the three networks of "management network," "service network," and "storage network" are separated, and each network uses dual uplinks, which are, respectively, connected to the corresponding switches [18]. Each blade server has two 20GBE converged virtual ports, which are interconnected through the backplane switch inside the blade box, and the external communication is completed through the blade box switch. Therefore, 2 20GBE fusion ports of each blade server are virtualized and 4 ordinary 10 GB ports are mapped to the blade server operating system.

The network deployment of 2 infrastructure servers is as follows. Each server network port: 4 10 Gigabit Ethernet ports, 2 FC ports.

Management network: 2 10 Gigabit Ethernet ports; carry Hyper-V management traffic and traffic during live migration of virtual machines.

Business network: 2 10 Gigabit Ethernet ports; ports that carry infrastructure virtual machines for external communication and services.

Table 1: Blade server cluster allocation.

Knife box	Blade	Host	Remark
	1	HV-Infra01	Infrastructure cluster
	2	HV-VDI-HOST01	
	…	…	VDI cluster 1
1#	8	HV-VDI-HOST07	
	9	HV-VDI-HOST16	
	…	…	VDI cluster 2
	16	HV-VDI-HOST23	
	1	HV-Infra02	Infrastructure cluster
	2	HV-VDI-HOST24	
	…	…	VDI cluster 2
2#	8	HV-VDI-HOST30	
	9	HV-VDI-HOST08	
	…	…	VDI cluster 1
	16	HV-VDI-HOST15	

Storage network: 2 FC ports; Hongshan FC storage is mounted to carry the resources and storage space required for the operation of the infrastructure server.

The network deployment of 30 desktop hosting servers is as follows. Each server network port: 4 10 Gigabit Ethernet ports, 2 FC ports.

Management network: 2 10 Gigabit Ethernet ports; carry Hyper-V management traffic and traffic during live migration of virtual machines.

Business network: 2 10 Gigabit Ethernet ports; ports that carry virtual desktops and virtual applications for external communication and services and data ports for users to access personal disks.

Storage network: 2 FC ports; Hongshan FC storage is mounted to carry 800 virtual desktops and user personal data.

In order to overcome the impact of dynamic network changes on video transmission, network QoS monitoring technology is introduced, and real-time monitoring is used to lay a good foundation for intelligent transmission control [19]. Add timestamps at the protocol layer to monitor network delays, add two fields to each packet, and record the last received timestamp (LRT) and the current sent timestamp (CST). After receiving the packet, the receiving end calculates the local packet sending delay according to the LRT and SCT of the packet. At the same time, according to the last time stamp (LST) that the receiving end has saved and the time when the message is currently received, subtract the processing delay of the peer end to obtain the processing delay of the packet in the network.

As shown in Figure 3, when B end replies to A, it is

$$\begin{aligned} \mathrm{LRT} &= TB+\Delta t1, \\ \mathrm{CST} &= TB+\Delta t1+\Delta t2. \end{aligned} \tag{1}$$

When end A receives the message from end B, its local is

$$\mathrm{LRT} = TA+\Delta t1. \tag{2}$$

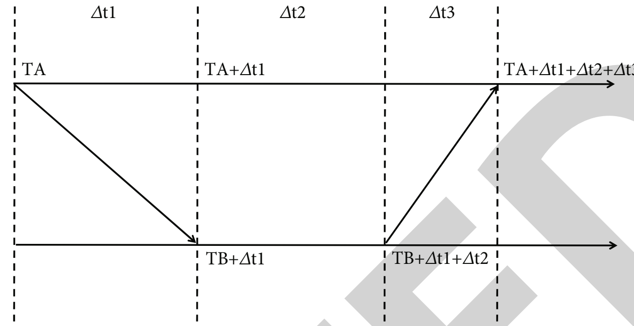

Figure 3: Calculation of packet transmission delay.

And its current time is

$$\mathrm{CT} = TA+\Delta t1+\Delta t2+\Delta t3. \tag{3}$$

At this time, the two-way delay of packet sending can be calculated as

$$\mathrm{CT} - \mathrm{LST} - (\mathrm{CST} - \mathrm{LRT}). \tag{4}$$

(3) Storage Deployment. The storage system adopts unified centralized storage deployment; that is, system data and user data are stored on the same storage. System data is accessed through the FC interface and stored in the form of FC-SAN. User data is accessed through the 10 Gigabit Ethernet interface and stored in the form of a file server. FC-SAN storage: it consists of Hongshan MS storage, dual-controller totaling 448 GB cache, 16 960GSSD hard drives, and 64 6 TB mechanical SAS disks; use FC to access the storage network to provide system operation and data storage services for infrastructure, virtual desktops, and virtual applications.

File storage: in order to enable users to retain personalized configuration and personal data in the cloud desktop mode, the configuration files, user personal data files, and operating system disks are separated. Use two file server virtual machines to form a file server cluster, provide file storage services for all users, configuration files and personal data files are centrally stored in the file server, and through CIFS (Common Internet File System) network share access [20].

(4) Component Deployment. Component installation consists of two parts: base platform components and virtual desktop components.

(1) Basic platform components: (a) Hyper-V server virtualization: using virtualization technology enables a physical server to run multiple virtual operating systems simultaneously. (b) Active directory: Microsoft's unified authentication management platform, used for centralized management of users and computers, unified identity authentication, etc. [18]. (c) DHCP server: dynamic IP address assignment protocol used to automatically assign IP addresses to all virtual machines. (d) CA server: certificate authority, used to issue certificates for the entire cloud desktop platform. (e) File

Table 2: Virtual server system deployment role.

Role	Virtual server	Function
Active directory	DC01, DC02	Active directory
DHCP	DHCP01, DHCP02	DHCP service
	SOFS01, SOFS02	User file storage
File server	SOFS-CLU	File server cluster IP
	Fileserver	File server access IP
Virtual desktop controller	RDBroker01, RDBroker02	Cloud desktop delivery controller
Desktop access server	RDWeb01, RDWeb02	User access
SCVMM	SCVMM01	Cloud desktop management
Virtual desktop database	RDSQL01, RDSQL02	SQL database
Access gateway	RDGW01, RDGW02	RD gateway

Table 3: System function test situation.

Serial number	Testing method	Expected outcome	Actual results
1	After normal input or abnormal input information, perform addition and modification operations	If no information is entered in the required fields, a warning box will pop up	As expected
2	Fuzzy and exact queries, see the results	The list will show the correct query results	As expected
3	Check whether the list information is updated correctly after adding, modifying, and deleting operations	The list is updated with new or modified information	As expected
4	Click on a control with an event listener	Response to events such as refresh	As expected
5	Book an experiment	The seat status changes to reserved and the name of the reserved person is displayed	As expected
6	Bind power supply devices corresponding to seats in batches	The sequence number of the seat corresponds to the serial number of the power supply, and the binding is successful	As expected
7	Check the code hint box information for errors	Accurate prompt information	As expected
8	Click on tree or parent class list	The subcategory list information will be refreshed accordingly	As expected
9	After making an appointment for the experiment, swipe the card at the specified time and other times to get on the machine	Open within the specified time, and other prompt boxes will pop up	As expected
10	Perform purchases, borrows, scraps, etc. to change inventory of equipment and low-value items	Inventory statistics are updated accurately	As expected
11	Loaned equipment is expected to be outstanding	The expiration prompt box will turn red	As expected

server: used to store user personal files, configuration files, SQL database daily backup files, etc.

(2) Virtual desktop components: (a) RD connection broker: used to provide deployment, delivery, management, and more of virtual desktops. (b) RD Web access: a Web service used to provide users logging in to cloud desktops. (c) RDVH virtualization host: used to host all virtual desktop virtual machines. (d) RD gateway: used to proxy cloud desktop client and backend virtual desktop traffic. (e) RD licensing: license issuance to provide the RDS virtual desktop platform. (f) RD session host: used to provide session-style shared virtual desktops

(5) System Deployment. The operating system of the infrastructure and virtualization host server is deployed as Windows Server 2016 Datacenter Edition, and the cloud desktop operating system is deployed as Windows 7 SP1 64-bit Enterprise Edition. The specific roles and functions of the virtual server are described in Table 2.

3.2.4. Cloud Desktop Operation and Monitoring. After the cloud desktop platform is deployed, resolve the custom domain name through the RD Web (desktop access server) IP address or DNS, open the cloud desktop homepage to log in, enter the user name and password in the active directory to display the laboratory cloud desktop collection, and click the collection icon to enter the cloud desktop. After the cloud desktop is successfully allocated, you can see the custom system desktop and preinstalled application software.

By logging into the cloud desktop platform on each terminal in the laboratory, you can obtain an operating system with preinstalled application software; all operations and data storage of students are performed in the cloud platform data center, without occupying local client resources. Through intensive and unified management, it can not only meet the needs of customized special operating systems and application software but also realize the purpose of resource sharing and data security. Through the third-party component NetScaler monitoring platform, it is more convenient to monitor the software and hardware usage of cloud desktop data center and cloud desktop connection [21]. From the traffic monitoring graph and gateway monitoring, it can be seen that when about 100 cloud desktops are in normal use online at the same time, the network bandwidth is about 300 M, and the utilization of CPU and memory also remains at a normal level.

4. Analysis of Results

4.1. System Function Test. System functional testing is to test all functional modules in the system, verifying that these modules work correctly and meet the user's needs. Before testing, based on previous project experience, we sorted out the test documents for the errors that are easy to make in the system development process and tested the functional items of the module according to the content of the documents. After discovering the problem, correct it immediately, improve the test document when new problem occurs, and repeat the test until no problem occurs; some contents of the test document are shown in Table 3.

4.2. Thin Client Performance Test. When testing the network bandwidth, use the thin client protocol machine to access the cloud platform, open the Thunder player to play the movie application, and then use the thin client machine to access the cloud platform using RDP; when RDP is playing a movie, the traffic is mainly in the range of 1.2~1.6 Mbps, and the network delay is less than 1.3 s. In the system management software, the Hyper-V+Deskpool mode is used to manage cloud desktops, and the client-side video broadcast is very good, which can well meet the needs of users.

5. Conclusion

From the actual application effect of cloud desktop, VDI cloud desktop realizes the effective unification of user experience, data management, and operation and maintenance management. The cloud desktop platform abandons the architectural differences of software and hardware resources and maximizes the utilization of software and hardware resources through virtualization technology, students in the absence of perceived system differences and resource shifts, uninterrupted and efficient use of laboratory resources. Through centralized software templates and storage, students do not need to install basic software and system configuration; they can send experiment and learning data to remote storage, for the needs of data mining on the cloud platform and students' experimental analysis in the later stage. Unified configuration and centralized management, effectively improve the efficiency of operation and maintenance management, reduce deployment and maintenance costs, more secure and flexible resource sharing and resource allocation for students.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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