

Application of VDI Virtual Desktop Cloud-Based Computer Room Construction in Universities

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Abstract: Traditional computer rooms face challenges such as difficulties in hardware updates and maintenance, complex software licensing management, and cumbersome data backup and recovery. These issues have posed significant challenges to the informationization construction in universities. However, the construction of computer rooms based on VDI (Virtual Desktop Infrastructure) virtual desktop cloud can effectively address these problems and provide a more reliable, efficient, and flexible overall solution for the informationization construction in universities. Therefore, this paper will explore in-depth the application of VDI virtual desktop cloud-based computer room construction in universities.

Keywords: VDI virtual desktop cloud, computer room, university, strategic recommendations

1. Introduction

The rapid development of computer technology and the popularization of higher education have made computer rooms play an important role in universities. However, traditional computer room constructions face various challenges and issues, such as resource waste, high energy consumption, and inconvenient equipment management. To address these problems and enhance the quality of teaching, many universities have started adopting computer room solutions based on VDI virtual desktop cloud. VDI technology virtualizes the operating system and application software of computers, allowing users to access remote virtual desktops through the network, enabling resource sharing and flexible management.

2. Basic Concepts and Principles of VDI Virtual Desktop Cloud

2.1 Basic Concepts

VDI which stands for Virtual Desktop Infrastructure, is a virtualization technology that runs desktop operating systems in virtual machines and transmits the graphical interface of the desktop to users' terminal devices through efficient network transmission techniques. VDI technology separates desktop operating systems from application programs, centralizes their management on the server-side, and provides virtual desktops to end-user devices, thereby enhancing desktop manageability and security.

Virtual desktop cloud is a solution that applies VDI technology to the field of cloud computing. It deploys virtual desktop services in the cloud, allowing users to access complete virtual desktops through the internet. Building on VDI technology, virtual desktop cloud utilizes cloud computing technology to achieve resource sharing, scalability, and elasticity, thereby reducing deployment and management costs. In summary, VDI virtual desktop cloud technology allows users to access their desktops anytime, anywhere without relying on physical devices. This significantly improves work efficiency and flexibility, making it an important direction for current enterprise and university informationization construction.

2.2 Principles

2.2.1 Virtualization Platform

VDI virtual desktop cloud utilizes a virtualization platform as its infrastructure, such as VMware, Hyper-V, XenServer, etc. The virtualization platform virtualizes physical servers into multiple virtual machine instances, each running a complete operating system and application programs. The

virtualization platform uses a virtual machine monitor (VMM) to isolate virtual machine instances from physical servers, ensuring their security and stability. The virtualization platform also provides resource scheduling and management capabilities for virtual machine instances. For example, it dynamically adjusts resource allocation based on CPU, memory, storage usage of virtual machine instances to improve resource utilization and performance^[1].

2.2.2 Virtual Desktop Pool

VDI virtual desktop cloud deploys virtual machine instances in virtual desktop pools, where each pool contains multiple virtual machine instances to provide desktop virtualization services to users. Virtual desktop pools allocate different virtual machine instances to users based on their requirements and permissions. For example, high-performance CPU and large memory virtual machine instances can be allocated to users with high-performance needs, while lower-performance CPU and smaller memory virtual machine instances can be allocated to reduce costs and improve resource utilization^[2].

2.2.3 Remote Desktop Protocol

VDI virtual desktop cloud uses a remote desktop protocol to transmit user's desktop requests to virtual machine instances for remote desktop access and usage. The remote desktop protocol converts user's desktop requests into network packets, transmits them to virtual machine instances, and then transmits the screen output of virtual machine instances back to users' terminals^[3]. The remote desktop protocol provides multiple transmission methods and protocols such as UDP, TCP, HTTP, etc., offering high flexibility and scalability.

2.2.4 Resource Scheduling and Management

VDI virtual desktop cloud achieves resource allocation and management for virtual machine instances through resource scheduling and management techniques. For example, it dynamically adjusts CPU, memory, storage allocation of virtual machine instances based on users' needs and usage to meet their requirements and improve resource utilization. Resource scheduling and management can utilize management tools provided by the virtualization platform, such as vSphere, Hyper-V Manager, or third-party resource management tools like vRealize Operations Manager, System Center, etc.

2.2.5 Centralized Management and Monitoring

VDI virtual desktop cloud enables centralized management and monitoring of virtual desktop pools, virtual machine instances, users, and resources through dedicated tools. Centralized management and monitoring enhance system reliability, stability, and reduce management costs and risks^[4]. Management tools provide various functionalities such as configuring, deploying, cloning, and backing up virtual machine instances, managing and monitoring user permissions, access, and usage, and monitoring and reporting system performance, resource utilization, security, etc.

3. Advantages of VDI Virtual Desktop Cloud-Based Computer Room Construction in Universities

3.1 Provision of Quick Desktop Systems for Teachers and Students

Virtual desktop cloud utilizes NVMe solid-state disk storage, which offers numerous advantages for users. Virtual machines in the form of virtual desktops have fast system booting, rapid performance, and quick software launch, enabling users to quickly start and use their personal desktops. This efficiency significantly improves teaching and learning productivity, allowing teachers and students to access and utilize the required tools and resources more quickly, thereby enhancing the learning experience and satisfaction. Moreover, virtual desktop cloud excels in security^[5]. Users can operate within a completely isolated virtual environment, reducing the risks of system attacks and virus intrusion. Virtual desktop cloud also provides flexible resource management and allocation, allowing dynamic adjustments based on actual needs, thus meeting different users' requirements and enhancing their experience and satisfaction. Additionally, virtualization technology better utilizes computer resources, improves resource utilization efficiency and management efficiency, and reduces hardware and management costs, presenting significant advantages for universities in terms of finance and administration.

3.2 Support for a Wide Range of Operating Systems and Software

Through this architecture, users can access various operating systems, including Windows XP, Windows 7, Windows 10, Windows Server, Linux, as well as domestic operating systems. Additionally, most software can stably run in this environment, providing universities with greater flexibility and choices. With a VDI architecture-based cloud computer room, universities can select suitable operating systems and software based on teaching and research needs without considering hardware compatibility issues. This offers universities more autonomy and choices, enabling them to better meet the requirements of different disciplines, courses, and research directions. Furthermore, a VDI architecture-based cloud computer room provides improved software management and maintenance, allowing software installation, upgrades, and configurations within the virtual layer of server clusters, enhancing software manageability and maintainability.

3.3 Convenience of Maintenance

Administrators can perform daily maintenance of the cloud computer room through web-based operations, using any device (computer, mobile phone, tablet) from anywhere. This includes updating system software, powering on/off terminal devices, deploying exam systems, and handling routine troubleshooting. With simple network access, administrators can remotely manage and monitor the entire system, increasing maintenance efficiency and flexibility while reducing time and resource waste. VDI architecture-based virtual desktop cloud also offers better system monitoring and alerts. Administrators can monitor the system in real-time through web-based interfaces, obtaining insights into system operation status and performance metrics. Additionally, the system can be configured with automatic alert mechanisms, providing timely notifications to administrators in case of system failures or abnormalities, allowing prompt actions for resolution, ensuring system stability and availability.

3.4 Elastic Resource Allocation

VDI architecture-based cloud computer rooms can allocate resources elastically according to demand, providing universities with greater flexibility and choices. During class hours, the system can meet all students' teaching requirements, offering a stable and efficient teaching environment. During non-class hours, it can provide students with practical training environments to meet their training needs. Different configurations of desktop systems can be flexibly allocated based on specific training requirements, satisfying the training needs of teachers and students. This flexible resource allocation and sharing improve resource utilization efficiency, resulting in cost and space savings for universities. Through a VDI architecture-based cloud computer room, computer resources can be better utilized, improving resource utilization efficiency and management efficiency, reducing hardware costs and management costs. Additionally, the VDI architecture-based cloud computer room offers improved resource management and allocation, dynamically adjusting based on actual needs to meet the requirements of different users, enhancing user experience and satisfaction.

3.5 Scalability and Upgradability for 5 to 8 Years

VDI architecture-based cloud computer rooms possess excellent scalability and upgradability, providing universities with greater flexibility and choices. After 5 to 8 years of use, when resources are insufficient to support teaching requirements, upgrading all desktop resources can be achieved by adding a few servers. This scalability allows universities to flexibly adjust and expand the scale of their computer rooms, prolong the lifespan of equipment, reduce the frequency of hardware updates and replacements, and lower costs and resource waste. VDI architecture-based cloud computer rooms also provide improved resource management and allocation, dynamically adjusting based on actual needs to meet different users' requirements, enhancing user experience and satisfaction. Additionally, the system can be configured with automated management and monitoring mechanisms, enabling real-time monitoring and management of the entire system, ensuring system stability and availability.

3.6 Resource Conservation and Energy Efficiency

Based on VDI architecture, cloud terminals consume less than 10W of power, which is significantly lower than the power consumption of traditional PCs. By utilizing cloud terminals in teaching, universities effectively reduce electricity consumption, resulting in savings of hundreds of thousands of RMB in annual electricity costs. Moreover, the reduction in the number of physical computers also

contributes to decreasing the production, maintenance, and disposal of related equipment, further advancing energy and resource conservation efforts and ultimately achieving environmental sustainability goals. VDI architecture-based cloud computer rooms also improve resource utilization efficiency and management efficiency, reducing hardware and management costs. Through VDI architecture, multiple desktops can be virtualized on a single server, improving the utilization efficiency of computer resources, reducing hardware costs and energy consumption. Additionally, VDI architecture-based cloud computer rooms offer improved resource management and allocation, dynamically adjusting based on actual needs to meet different users' requirements, enhancing user experience and satisfaction.

3.7 Online Training during Epidemics

During epidemics when teachers and students cannot attend face-to-face classes, administrators can use VDI-EDaaS platforms to transfer all server resources from offline to online. Teachers and students can access cloud-based resources through web interfaces for normal class sessions. This provides universities with a flexible solution to cope with epidemics, ensuring the continuity of teaching and students' learning experience. Specifically, VDI virtual desktop cloud-based computer room construction can provide a stable and efficient remote teaching environment, allowing teachers and students to access remote desktops via cloud services without physically operating computers. This effectively reduces gatherings and lowers the risk of epidemic transmission, ensuring the health and safety of teachers and students. Moreover, VDI virtual desktop cloud-based computer room construction offers flexibility, allowing dynamic adjustments based on teachers' and students' actual needs, meeting different users' requirements, and enhancing their experience and satisfaction.

4. Recommendations for the Application of VDI Virtual Desktop Cloud-Based Computer Room Construction in Universities

4.1 Provision of Convenient Computing Resources

The construction of VDI virtual desktop cloud-based computer rooms provides students and teachers with an efficient, secure, and convenient learning and working environment. By logging into virtual desktops online, students and teachers can access efficient computing resources that are centralized in the cloud, avoiding the issue of low performance on terminal devices that may hinder productivity. The construction of VDI virtual desktop cloud-based computer rooms also enhances security by strengthening management and control, ensuring the security and privacy of user data. Moreover, the virtual desktop environment enables synchronous collaboration between teachers and students during classes or research, facilitating academic cooperation. This mechanism offers students and teachers a more convenient and efficient way of learning and working, allowing them to better utilize computing resources and learning environments, improve learning and work efficiency, and provide strong support for the informationization construction of universities.

4.2 Enhancement of Educational Informationization

With the application of VDI virtual desktop cloud-based computer room construction in universities, the level of educational informationization is further elevated. Schools can personalize the virtual desktop environment based on teaching needs and students' actual situations, providing students with efficient, secure, and personalized computing resources and learning environments that meet their individual requirements and learning habits, thereby enhancing students' learning efficiency and outcomes. Simultaneously, VDI virtual desktop cloud-based computer room construction can improve teachers' educational informationization literacy, enabling them to better utilize information technology in course design and organization of teaching activities, thereby improving the effectiveness and quality of teaching. Through VDI virtual desktop cloud-based computer room construction, universities can better meet the requirements of educational informationization in the era of information technology, elevating the modernization level of education, teaching, and management. This mechanism offers strong support to universities, enabling them to better leverage information technology in education and teaching, fostering the mutual development of students and teachers.

4.3 Enhancement of Data Security

Data is one of the most critical assets within universities, containing a wealth of sensitive information, such as personal information of students and teachers, academic achievements, research data, etc. The leakage of such data can have severe consequences for universities. The virtual desktop environment significantly reduces the risk of data leakage by storing computing resources and data in the cloud, accessible only to authorized users. Students or any unauthorized individuals cannot obtain sensitive data from terminal devices or internal networks, ensuring the security of campus data. Furthermore, the virtual desktop environment can enhance data security and confidentiality through measures such as access control and data encryption. Through VDI virtual desktop cloud-based computer room construction, universities can better safeguard the security of campus data, prevent data leaks and breaches, and ensure the integrity and reliability of school information security.

4.4 Reduction of Device Maintenance Costs

Traditional computer labs require a large number of hardware devices and software support, which requires significant time and effort for device management and maintenance, placing considerable pressure on IT teams. In VDI virtual desktop cloud-based computer room construction, all hardware devices and applications are stored in the cloud and can be managed and controlled centrally. This allows IT teams to concentrate on maintaining the virtualized environment, thereby reducing overall device maintenance costs and workload. VDI virtual desktop cloud-based computer room construction can also provide better cost-effectiveness for schools. Maintenance and management of the virtualized environment can be conducted in the cloud, significantly reducing the costs of hardware devices and software support. Additionally, VDI virtual desktop cloud-based computer room construction can improve device utilization, reduce device idle time, and save IT resources and energy. Through VDI virtual desktop cloud-based computer room construction, universities can effectively reduce device maintenance costs and workload, and improve the utilization of IT resources.

4.5 Achievement of Sustainable Development

Cloud computing platforms can automatically allocate resources, minimizing the waste of idle resources. By virtualizing resources, more computing resources can be provided without the need for additional hardware devices, while excessive energy consumption can be avoided. Moreover, in long-term use, IT teams can upgrade, update, and maintain the virtual desktop environment based on actual needs, achieving sustainable development. This approach not only reduces energy waste but also promotes informationization construction. VDI virtual desktop cloud-based computer room construction can also reduce device disposal and waste by improving device utilization and extending device lifespan, thereby realizing sustainable development. Finally, the development of VDI virtual desktop cloud technology requires joint efforts and support from the industry to contribute to the future of education. Universities can collaborate with industry and research institutions to contribute to the sustainable development of education and society.

4.6 Provision of Lifelong Learning Opportunities

The application of VDI virtual desktop cloud-based computer room construction in universities can provide lifelong learning opportunities for students and teachers. Through the virtual desktop environment, students and teachers can access learning resources and course content anytime and anywhere, whether on campus, at home, or other locations, enabling continuous learning and work. This flexibility and convenience remove the limitations of time and place on learning, providing students and teachers with more learning and development opportunities. VDI virtual desktop cloud-based computer room construction also supports remote education and online learning. Schools can offer remote teaching and online courses through the virtual desktop environment, allowing students to participate in learning anytime and anywhere. This online learning model can meet students' personalized learning needs, enabling them to learn at their own pace and schedule, enhancing flexibility and autonomy in learning. Additionally, VDI virtual desktop cloud-based computer room construction can support the concept of lifelong learning. Students and teachers can access the latest learning resources and information at any time, continuously updating their knowledge and skills.

5. Conclusion

The application of VDI virtual desktop cloud-based computer room construction in universities has significant advantages and potential. It can provide students and teachers with efficient, secure, and convenient learning and working environments, improve educational informationization and data security, reduce device maintenance costs, and achieve sustainable development. However, it is necessary to strengthen training and skill development for teachers and students, establish a comprehensive security management system, promote its adoption and usage, optimize system performance and user experience, and strengthen cooperation with enterprises and innovative research. Based on these factors, it is believed that through collective efforts and support, continuous innovation and application development of virtual desktop cloud technology will bring more opportunities and challenges to universities and make greater contributions to the field of education and societal development.

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