Application research of desktop virtualization technology based on VOI in computer room management of colleges and universities

Yejian Tang, Xuxing Ding
Wanjiang college of anhui normal university, Wuhu City 241000, China

Abstract. VOI desktop virtualization technology has realized the new management mode of "centralized management, node operation and maintenance" in the computer room. It has overcome the disadvantages of a large number of management work required by the former protection card mode and the need for high-performance server for VDI desktop virtualization. "Disk network dual standby" technology gives full play to the local performance of the computer, reflecting the excellent local performance and high reliability of the client under centralized management. By integrating virtual machine technology into the VOI image system and relying on the advantages of local computing, a variety of teaching and experimental environments are constructed to completely meet the needs and lay a good foundation for the smooth development of research.

1. Introduction
Nowadays, nearly all professional courses in colleges and universities use computers to assist teaching. Colleges and universities usually have a certain number of computer public rooms to cope with the growing teaching demand. The management level of computer rooms is directly related to the smooth progress of computer teaching. As an important place for computer teaching and cultivating students' practical innovation ability, the computer room is faced with great pressure such as insufficient management personnel, complex demands and various software. How to choose the appropriate management platform, improve the technical level of the computer public room, to adapt to the new changes of the school multi-campus, multi-demand, is a very practical problem [1].

Most public computer rooms in universities are managed by computer room administrators, who are responsible for the maintenance of thousands of computers in dozens of computer rooms in schools. The huge number of computers, fewer computer room administrators and the growing demand for use make the problems faced by public computer room management increasingly prominent [2]. At present, hard disk protection card is widely used in public computer rooms as a means of operation and maintenance. Although hard disk protection card has many excellent functions, there are still various problems in the use process that confuse the managers:

1.1. The construction of teaching environment is complicated
Different specialized in computer systems and software applications have different requirements, which requires the computer room management can according to the specific requirements of the course of different professional, different configuration of computer hardware resources and professional software, namely room according to the different teaching task, the construction of the need to repeat and restore the teaching environment, this kind of system, professional task scheduling, it is difficult for computer room management [3].
1.2. Single point of failure many
The protective card is inserted into the PCI slot of the computer motherboard, which is prone to single point failure such as failure to identify, causing the computer to fail to start up. The performance of hard disk reading and writing is decreased due to repeated system transmission\textsuperscript{[4]}. Meanwhile, frequent sector reading and writing operations in certain areas of the hard disk are easy to cause local damage to the hard disk sector and affect the use. Some courses require the system to be fully open, that is, teaching and experiments are carried out in the state without system protection. The continuity of teaching requires frequent reduction and protection function of switch protection card, which is easy to reduce the security of the system, or even make the system crash and cannot be used\textsuperscript{[5]}.

1.3. Maintenance difficulties
Room is much and distribution of each campus, even in a school district may also be distributed in different floors, in the face of such a large number of computers, and some room for high load operation and non-standard operation, computer hardware and software failure, managers can only on the campus, the machine room, processing all kinds of problems, insufficient ability of fast response, high maintenance cost; In order to meet the needs of teaching, the management personnel can only constantly adjust the system state in each computer room to meet the needs of the course. It is impossible to update the system and install new software across the network segment, as well as the inconsistencies in hardware configuration of each machine room. The management personnel can only update and install the system one by one, with a large workload. If there are multiple machine rooms and systems to be maintained, the same work will be repeated for many times. All these inconveniences make it difficult for public computer rooms to meet the demand of full-service under the new situation. Computer room management staff urgently needs a centralized management, flexible desktop management scheme to deal with various shortcomings in the operation and maintenance of the computer room.

2. Desktop virtualization
Desktop cloud system is a dedicated education, government, enterprises, military and other units to provide front-end to back-end desktop cloud system software, desktop cloud system provides host management, template management, virtual machine management and desktop management modules, through simple operation can quickly build the government desktop cloud environment. Desktop cloud system delivers desktop to end users in the form of service\textsuperscript{[6]}. All operations are completed uniformly by the back-end WEB interface of the administrator, which improves the flexibility of IT operation and maintenance and simplifies operation and maintenance. Front-end users only need to understand how terminals and virtual desktops work\textsuperscript{[7]}. Desktop cloud system also provides a wealth of management strategy, connection strategy, etc., by setting the desktop connection strategy, users can use a variety of terminal devices for desktop security access at any time, anywhere, to achieve the traditional PC can not match the security, flexibility\textsuperscript{[8]}.

Desktop virtualization refers to the complete virtualization of terminal system (computer desktop), the generation of an independent mirror system to save and virtualize the server, and then provide the desktop system including operating system and application software to the client through the virtual desktop protocol. Currently, the architecture adopted can be divided into VDI(virtual desktop infrastructure) desktop and VOI(virtual operating system infrastructure) desktop\textsuperscript{[9]}. The basic features of VDI desktop applications are "centralized computing, distributed display." All the operations of the client are performed in the server, while the desktop user is only responsible for input, output and interface display, and does not participate in any calculation and application, as shown in figure 1. The basic feature of the VOI desktop is "centrally managed, locally run". The client USES the virtual container technology to completely virtualize the terminal and build a virtual container pool, on which the operating system is deployed. Since the terminal has been completely virtualized, the "hardware" they face is already virtual from the perspective of the operating system. That is to say, the scattered terminal resources (operating system, application software, etc.) form a mirror system, centralized management in the server, and then cache to the client as needed. Considering the environment and
practical application, VOI is more adaptable to the user's environment. It can be run independently of the server and network, so that VOI has better usability, security and user experience. VOI greatly reduces the cost of terminal operation and maintenance, realizes centralized, unified and flexible client management, and greatly improves the working efficiency of managers\[^{10}\].

![Desktop virtualization platform topology diagram](image)

The desktop cloud data center consists of multiple servers, storage, and networks. Through virtualization technology, memory, CPU, storage and other resources are integrated into unified computing resources, and then relevant resources are allocated on demand. Virtual machine files, virtual desktop centralized storage in the data center room of fc-san \(\text{ip-san}\), unified backup, management and distribution.

3. VOI desktop virtualization technology room deployment

3.1. VOI desktop virtualization product deployment instructions

![Diagram of VOI desktop virtualization product deployment](image)

As shown in figure 2, the desktop virtualization architecture is divided into three parts: virtual desktop infrastructure services, desktop virtualization management platform and terminal components. Virtual desktop infrastructure services are composed of server virtualization products and server management platform, providing underlying virtual machines and management support for desktop virtualization platform, while desktop management and delivery are provided by product desktop management platform.

Desktop management platform in the deployment, the host will be the user's physical server virtualization management support, and create a good virtual machine template in the host management
platform, through the desktop management platform to quickly clone multiple virtual desktops from the template. Administrators distribute virtual desktops through domain users and use dedicated data stores to store users' configuration data. The desktop is provided by the administrative server.

In the process of user use, the user USES the terminal or PC to access the desktop server through the network, and the desktop server for identity authentication, verification through later access to the virtual desktop. You can also control whether you can use peripherals on the desktop based on your policy, and you can get smooth graphics and support for video and 3D. Communication and data between the user and the virtual desktop are securely encrypted throughout the access.

3.2. Desktop virtualization access gateway

Desktop virtualization access gateways are middleware through which users authorize connections and forward data. When linking, customers can check the session information to ensure that the back-end user data is isolated from the front end, and use OpenSSL encryption transmission protocol to improve the security of user data. Users can access the desktop through the desktop client access gateway access desktop, so as to achieve desktop access. See figure 3.

Virtual desktop (VDI) delivery, computing, data centralization: the virtual desktop used by users is centrally created on the server of cloud computing center and delivered to end users through desktop virtualization protocol. Computing, data and management are concentrated in cloud computing center, which improves resource utilization and data security and reliability.

Multiple desktop delivery: support multiple desktop delivery, including the whole series of Windows products, Linux system, to meet the needs of different users and different scenarios for the desktop;

Business continuity guarantee: the host server has intelligent highly available host management ability, real-time detection of the performance load of multiple hosts, when failure occurs, automatically create and start the virtual machine on the host with low load, to ensure the normal operation of the virtual machine, so as to guarantee the user's business continuity. The load balancing and high availability of the access network improve the high availability of the architecture.

Multi-desktop delivery, seamless switching: according to the needs of users, different types of virtual desktop can be delivered at the same time, to meet the user's multi-system operation on the same terminal, and can use shortcut keys to switch between different systems;

More intelligent virtual desktop deployment: cloning technology based on link, provide the most easy to deploy, upgrade and maintenance of the style of the virtual desktop pool, and further enhance the intelligence and automation in the process of virtual desktop pool in the deployment capabilities, as long as according to the deployment wizard, under any scenario, you can complete the automatic deployment of virtual desktop pool;
Breakthrough video decoding technology: complete video decoding by special equipment alone, reduce CPU occupancy rate, save more resources for the system, make users play high-definition video, reduce video wiring, atoning and other phenomena, so as to bring better video experience;

Flexible terminal access: users can access the cloud computing platform from traditional PC, thin client or zero client, tablet computer or even personal mobile device to access their desktop applications and user data. Flexible mobile office anytime and anywhere;

User terminal asset management: input unified equipment information of terminal equipment connected to cloud management platform, form related asset report, send warning information when equipment changes, improve the efficiency of hardware asset management, and ensure the asset safety of equipment under cloud architecture.

3.3. Server consolidation
By creating multiple virtual machines on the physical server, the business originally running on multiple servers can be run on multiple virtual machines on the same server, so as to realize the integration of the number of servers and improve the resource utilization of a single server, as shown in figure 4.

Figure 4. Server consolidation diagram

Host server supports user through the WEB graphics interface way to create, delete, virtual machine, support according to the need to choose the appropriate number of CPU cores, memory size, disk size, type of network, users can load in the same physical machine for virtual machine drive, install the operating system and application system, like in the physical machine run all kinds of business.

Business continuity guarantee: have intelligent highly available host management ability, real-time detection of the performance load of multiple hosts, when failure occurs, automatically create and start the virtual machine on the host with low load, to ensure the normal operation of the virtual machine, so as to guarantee the user's business continuity. The load balancing and high availability of the access gateway improve the high availability of the architecture.

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4. VOI desktop virtualization technology room advantages
With the innovation and development of VOI virtual desktop technology, there are more choices in the construction of the computer room, which is the best choice for the large-scale deployment of the computer room. To build a management platform based on VOI desktop virtualization technology, the various practical needs faced by public computer rooms in colleges and universities have been greatly satisfied.
4.1. Centralized management, local operation
It greatly integrates the hardware resources of the computer rooms in multiple campuses, and changes from the original decentralized management based on protection card operation and maintenance mode to a highly centralized management mode. The virtual terminal management system realizes the local cache of the mirror system through the client virtual container. The mirror system on the server is cached to the local hard disk in the way of "using while down", and makes full use of the network bandwidth to quickly realize the exact consistency of the mirror system on the server and the local cache image. The security and stability of the public computer room are improved, and the response speed of the local computer is significantly improved.

4.2. Flexible management mode
Each system image saved in the server is composed of multiple nodes (snapshots), where each node can be published as a separate virtual desktop system; When the client starts up, the server will assign the mirror system to the client according to the preset Settings. The number of system images is planned according to the actual requirements. A certain amount of general software is installed in each system image, and various professional software is installed in corresponding nodes according to the characteristics of each professional course. Meeting the requirements of multi-system and multi-specialty courses has always been the difficulty of computer room management, but now we just need to schedule the corresponding nodes and publish them to the launch menu.

4.3. The same security as the protection card
The desktop virtualization management system can realize the restart and recovery of the client system. Also owns rich client control strategy, auxiliary control to the selected system, such as black and white list management for Internet access, to ban the user access to certain sites, users shall be forbidden to use the USB interface, drives and other equipment, can also remote control, remote monitoring, custom remote command, time synchronization, banned the client set up the IP address and gateway, software license management, plan management, user roaming, etc.

4.4. Improve operation and maintenance efficiency
Desktop management is transferred from distributed mode to nodal mode, realizing centralized and unified application and flexible application of public computer rooms under management. Managers can complete most of their work in the virtualization management platform, and their work efficiency is greatly improved. The desktop virtualization management server is responsible for the distribution and management of teaching images in the public computer room of the university. The desktop virtualization management server can be remotely connected to any place in the school, and it can realize the overall control of the public computer room by cooperating with the Internet of things technology in the computer room.

5. Double standby acceleration technology of disk network
Dual standby technology of disk network is an extension of VOI desktop virtualization technology. Since the mirror system is cached to the client's hard disk by the server and kept consistent with it, the client will automatically choose whether to start the mirror system from the server or the local hard disk when installing the startup control program of the mirror system. When starting up normally, firstly connect with the server to get relevant startup management data, and then start the local mirror system. In case of network failure, server down, etc., automatically select the mirror system from the local cache to start directly according to the reserved startup menu. Disk network dual standby technology can intelligently identify whether the local cache mirror is complete and the data is consistent with the mirror on the server. It can cache the mirror system to the local hard disk in the way of "using while down". After the cache is completely consistent, there is no need to continue to cache from the server, which can save network bandwidth and reduce the pressure on the server; When the local cache image is incomplete, start the client, the system image manager in the server will continue to cache the
system image data in the background in a silent way, and gradually start the local computer image system, until the complete cache.

A system template is a publicly available file in a data center that needs to be read from the template frequently when the virtual machine is started or read concurrently. Therefore, the read performance of the disk is likely to be bottleneck. Currently, the template is stored on the ordinary mechanical disk, and the reading speed is significantly different from that of SSD hard disk. Gold speedup is to store the template in the SSD hard disk buffer to improve the reading speed and achieve the purpose of acceleration, as shown in figure 5.

Platinum-accelerated is a desktop template that USES the free space in the system's memory to perform much better than a traditional mechanical hard disk.

![Figure 5. Dual standby acceleration technology of disk network](image)

Gold and platinum acceleration technology solves the problem of slow batch startup of virtual machines, reduces the waiting time of desktop startup users, also reduces the waiting time of startup storm, and greatly improves the IO reading speed of virtual desktop.

The dual standby technology of disk network effectively reduces the client's demand for server and network, guarantees the client's continuous, safe and stable operation, and provides a powerful guarantee for the management of the computer room system. It avoids the problem of starting storm, and truly realizes the high availability and high reliability of dual standby disk network, which is an efficient scheme for the maintenance of public computer rooms in colleges and universities.

6. Conclusion

VOI desktop virtualization technology has realized the new management mode of "centralized management, node operation and maintenance" in the computer room, which has overcome the disadvantages of a large amount of management work required by the former way of protecting CARDS and the need for high-performance server for VDI desktop virtualization. "Disk network dual standby" technology gives full play to the local performance of the computer, reflecting the excellent local performance and high reliability of the client under centralized management. By integrating virtual machine technology into the VOI image system and relying on the advantages of local computing, a variety of teaching and experiment environments are constructed to completely meet the teaching needs and lay a good foundation for the smooth development of teaching.

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