

Analysis of virtual storage technology and its application in the library

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Abstract—With the rapid development of computer technology, storage systems become more and more important, the virtual storage technology can simplify storage system and more and more attention. This article briefly describes the concept of virtual storage technology, focusing on the classification of the virtual storage; finally, the application of virtual storage technology in the library was analyzed and discussed.

Keywords—virtual storage; disk arrays; data recovery; library

I. INTRODUCTION

The data of sustained and rapid growth bring the data swelling pressure, it makes more and more enterprises store data as an important project to manage, resulting in storage management technology develop rapidly. Differences of storage devices so that the efficient management of these devices face many difficulties, storage virtualization technology is how to improve the management efficiency and how to integrate different types of storage resources, and how to provide a unified access interface to the user. Virtual storage management system to shield the differences of the different platforms with different attributes of storage devices, virtual access interface to provide users with a simple unified, the systems based on virtual volumes can be split and extended to provide users, they can increase or decrease storage capacity, and it has good scalability, reliability, availability, high performance, the system supports a variety of standard protocols and transparent to the user.

Storage virtualization is a storage technology hot spot from now to future, this technology has significant advantages in mass storage, and optimizing storage utilization, smoother management, improves system availability and overall performance, reducing the storage system management costs. However, the storage virtualization is still a lack of a high degree of standardization and compatibility between different virtual products to be further enhanced. As a technology being developed, there are many new applications to be developed.

II. VIRTUAL STORAGE

Traditional storage systems are usually directly connected to the PC or server, a PC-based storage is a private storage, it is not convenient centralized management, shared, expansion, backup and access control, no expansibility and low utilization rate; server-based side storage provides

storage services take up server resources when a large load on the system will significantly reduce the performance of the storage service, and server-side storage is not a proprietary system, the operating system has not been optimized, cannot provide efficient storage services.

Virtual storage is developed together with the computer technology, first began in the 1970s, it was small storage capacity, especially the small memory capacity and the cost is very high. in order to overcome this limitation, virtual storage technology was created, the most typical application is the virtual memory technology[1].

The so-called storage virtualization is virtualization of storage system separation of the actual physical storage entities and storage said. The application server is only assigned to them with the logical volume (or virtual volume) contact, rather than concerned about their data in which physical storage entities [2].

From a professional point of view, the virtual storage is an intermediate layer between the physical storage devices and users. The layer shielding the physical characteristics of the physical storage devices such as disk and tape, presented to the user is a logical device. The user through virtual storage mapping management and use of the logical device, so it can the management and use of specific physical devices.

From the user's point of view, the user can see the storage space is not a specific physical storage devices, the user managed storage space is not a specific physical storage devices. The user is free to use the storage space without having to concern the physical storage hardware (disk, tape), that do not have to care about the capacity, type and characteristics of the underlying physical device, just need to focus on the needs of its storage capacity and safe mode.

Virtual storage technology can not only improve the performance of the host access to storage devices, while the expansion of storage capacity is very convenient, it can protect the original resources, the dynamic expansion of the premise does not affect the normal data access.

The benefits of virtual storage technology for practical application are reflected in the following areas:

- Virtual storage technology to make an important indicator of the storage part of the network system: a single logical unit of storage capacity and access bandwidth relative to a single physical memory bank has greatly improved and adapted to the needs of

network applications, especially video network applications.

- In a virtual storage environment, regardless of the back-end physical memory entity to see what kind of equipment, servers and applications system are familiar with the logical mirror of the storage devices. Even if the physical memory entity to change its logical mirror is not changed, the applications do not need to care about the back-end storage, just focus on the management of storage space, storage management becomes simple, easy and flexible configuration.
- Virtual storage is an intelligent system, which allows customers with a transparent and effective way to store data on disk or tape, so that the customer's storage system to accommodate more data, more users can share the same systems.

III. CLASSIFICATION OF VIRTUAL STORAGE

The development of virtual storage is no uniform standard, from the topological structure of the virtual storage, there are two main ways: That is symmetric and asymmetric.

A. Symmetric virtual storage

Symmetric virtual storage technology put virtual storage control devices and storage software system, switching equipment integrated into a whole, Embedded in the network data transmission path. Storage management system by HSTD (High Speed Traffic Directors) embedded storage pool physical hard disk virtual logical storage unit (LUN), and port mapping, server-side mapping the visible storage unit for the operating system can identify the letter. When the server to write data to the storage network system, users only need to data written to a location designated as a mapped drive letter, Data through HSTD of high-speed parallel port, First written to the cache, HSTD contains a storage management system, the system will automatically complete the conversion by LUN to a physical hard disk of the target location [3].

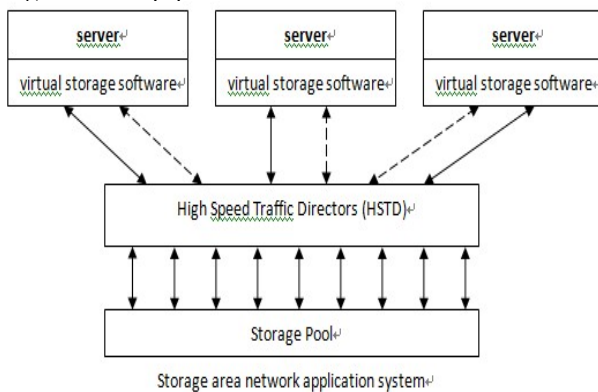


Figure 1. Symmetric virtual storage solution diagram[5].

Symmetric virtual storage has the following main features:

- Using large-capacity cache significantly increases data transmission speeds. When the server to read data from storage devices, it will be read the data connected with the current data storage location cache, and multiple calls to the data retained in the cache; When the server read the data, a great chance to find the required data from the cache, So that you can read directly from the cache; when the server to write data from the storage device, first of all data is written to the cache, until the server-side to stop writing data, then this data will write to hard disk from the cache , this writing mode is also higher than the directly written to the hard disk speed.
- Multi-port channel parallel to increase the data bandwidth, eliminating I/O bottleneck. Symmetric virtual storage device allows multiple hosts through multiple storage ports (up to 8) concurrent access to the same LUN.
- The logical storage unit provides high-speed access speed to the disk [3]. The storage system ensure the bandwidth requirements of the application, it is often designed to transfer the 512byte or more than the data block to reach the best I/O performance. When capacity requirements increase, the only solution is multiple disks (physical or logical) binding stripe sets, as a large-capacity LUN. Symmetric virtual storage system provides the server of the real large capacity, high performance LUN.
- Paired of the HSTD system fault tolerance performance. In the Symmetric virtual storage system, HSTD is formulated in pairs, between each pair HSTD through SAN Appliance with embedded network management services to achieve consistency of cached data and communicate with each other.

Symmetric virtual storage is also some shortcomings: the virtual storage control switching equipment directly between servers and storage devices, access to all servers on the storage device to go through the channels and management. Does not become a bandwidth bottleneck of the whole system in order to control switching equipment, the device will need a large capacity of the cache for data exchange, so often this control switching equipment are more expensive; Also because of the virtual storage control switching equipment directly between servers and storage devices, the device security for the entire system is very important, Once not operate normally, all data channels will be blocked, Resulting in collapse of the data transmission network system.

B. Asymmetric virtual storage system

Asymmetric virtual storage is not only a normal data access to the transmission channel between the server and the storage device, by configuring a virtual storage management achieve virtual processing of the storage pool. Virtual storage management through its FC ports connected to the storage network, and provides a central management point for centralized management of the entire storage network, also virtualized operation with disk array, to Virtual

LUN in the array as logical stripe set, and specify the access rights of each server operation every Strip (writable, readable, prohibit access)[5].

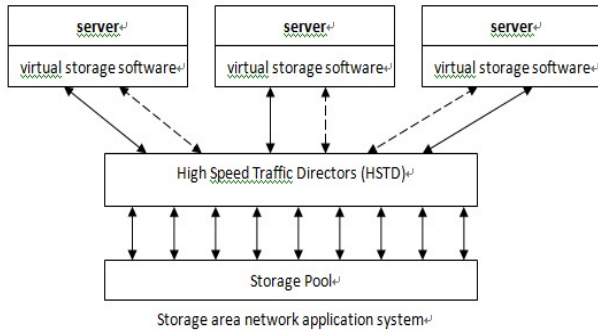


Figure 2. Asymmetric virtual storage system schematic.

Compare with asymmetric virtual storage and symmetric virtual storage, asymmetric virtual storage has the following advantages:

- Virtual storage controllers only work on the software configuration of all storage devices and the configuration and management information to the server, and thus its need a lot of high-priced hardware components and their prices are relatively low.
- The capacity of different physical hard disk in the array capacity logical combination and virtual stripe sets, multiple array controller port to bind to a certain extent, improve the available bandwidth of the system[3].
- Virtual storage controller is not the actual data channel on the performance of its hardware will not become the bottleneck of the system bandwidth, even if it do not normal operation, it will not cause network data channel blocking, improve system security.

However, the asymmetric virtual storage has some shortcomings:

- The safety of the asymmetric virtual storage is relatively poor. It is essentially a stripe set - disk array structure, once the band focus on a disk array controller is damaged, or this array to the switch on the path of copper GBIC damage will lead to a virtual LUN offline The band set itself is not fault-tolerant, a LUN damage means that the entire Strip which data is lost.
- To improve due to the bandwidth of the asymmetric virtual storage array port binding to achieve the effective bandwidth of the common Fibre Channel array controller is only about 40MB/S, so to reach hundreds of megabytes of bandwidth it means to call array of more than a dozen units, which would occupy dozens of switch ports, this is not achieved in only one or two switches in small and medium-sized network.

IV. THE APPLICATION OF VIRTUAL STORAGE IN THE LIBRARY

A. Data Mirroring

Data mirroring is to copy data between different storage devices through the bi-directional or unidirectional synchronization mode. The application of virtual storage technology cannot rely on equipment manufacturers and operating system support, mirrored in the same storage arrays and storage arrays. Libraries can make full use of the data mirroring technology mirror treatment of the acquisition of electronic resources, such as the full text of the journals of the Tsinghua Tong Fang database mirroring, Superstar electronic full text of the book mirror. So that the library is equivalent to actually have a full text copy of these databases, rather than using just the right.

B. Data Replication

Through the file system snapshot technology, virtual storage systems can avoid application server agent software and backup server communication bottleneck. Backup will give a snapshot of the backup window can be arbitrarily chosen, without time limit [4].

C. Fast backup

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D. Real-time data recovery

An important task in the data management work is the near-term backup data (which may be of historical data in a few weeks ago) transferred to the disk media rather than tape media. Data very rapidly (all files to recover within 60 seconds), and far more reliable data security with tape recovery, disk recovery when needed. At the same time, the entire volume data can be restored [6].

E. Service application testing

Virtual storage, some actual data environment for application testing do not have to worry about the destruction of vital data resources, the virtual system to provide a secure data platform for testing by copying the migration.

F. Storage space integration

This is the new direction of development of storage management, make storage closer to the application. The storage device is used to serve applications such as database communication. Integrate the behavior of storage devices and industrial applications, to obtain greater value, while significantly reducing the problems encountered during the operation.

The library purchased a large number of digital resources, including digital books, journals, newspapers, ancient books, multimedia resources etc, and so the storage space required

for these digital resources, usually in about a dozen TB, and the library each year they the acquisition of new resources, growth of the resources is also TB, additional hardware devices to expand the storage capacity alone will give the library a great deal of burden. Therefore, under the conditions of existing equipment to improve their utilization, to a certain extent to solve the problem of data storage.

Library virtual storage devices to create a virtual storage system, can increase the virtual management server platforms, networks of middleware and software and hardware, the original storage networks to isolate the application servers and storage devices, equipment from different manufacturers and digital resources stored unified management, the need to establish one or more virtual volumes of different sizes in the storage pool virtual volumes to read and write authorization assigned to the various applications on the server in the storage network in a storage pool. Application servers do not care to read data storage device configuration parameters, the physical location and capacity in a relatively transparent access to operating under the unified control of the virtual storage server, so to reach full use of storage capacity, centralized management storage, reducing storage costs of the purpose of information system in order to achieve integration, and also allows each storage device utilization is increased [4].

V. SUMMARY

Fully reflect its advantages in enterprise-class storage of virtualization technology: optimize storage utilization rates, makes management more smoothly, improve the availability and overall performance of the entire system, and reduce the

entire storage system management overhead and so on. From the current situation, storage virtualization is still a lack of a high degree of standardization, the compatibility between the different virtualization products to be further enhanced, the compatibility between the different virtualization products to be further enhanced, although the great advantages of the virtual technology, we are not able to ignore some of the potential problems of virtual technology, so that there will be more conducive to the development of virtual technology direction of intelligent.

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