Application Analysis of Virtualization Technology Based on General Server Small Cell

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Abstract. With the growth of mobile communication data volume, as an infrastructure server, its performance and system reliability have become the bottleneck in the entire physical architecture. The purpose of this paper is to study the application analysis of virtualization technology based on general server small base stations. Through the transformation and upgrading of small server base stations. Improve the performance of the system through virtualization technology; use cluster technology to solve the single point problem of equipment and achieve high availability of business. This article uses IBM's dynamic Lpar virtualization technology to adjust the system resources of different partitions to improve system performance according to the different peak load times of the partitions. Then use the PowerHA cluster principle to establish a cluster on the AIX operating system between different hosts to solve all problems. Single point of partition problem. This article also clarifies the basis for server virtualization needs. Using VMware vSphere-related components to realize the virtualization of the server on the campus. Solutions are also provided for the network and storage used in the virtualization process. This article gives an in-depth introduction to its server virtualization storage capacity, memory conditions, CPU performance and internal configuration, and develops a virtualization service system, which enhances the scalability of the application environment, strengthens the configuration of application services, the utilization efficiency of various resources of the server is improved, and the energy consumption cost of the computer room is reduced. Research shows that this article uses PowerHA to achieve high availability of system partitions, and the switching between servers can be controlled within 2 minutes, which greatly improves the high availability of the system.

Keywords: Server Small Cell, Virtualization Technology, Server Virtualization, Dynamic Resource Scheduling

1. Introduction
Virtualization technology is a cutting-edge technology, which can optimize and manage the IT infrastructure of various companies on a global scale, and at the same time is conducive to operational security. The function of virtualization technology is to streamline the process of repeated software allocation and increase hardware memory capacity. It can be seen that virtualization technology has a
revolutionary impact on the IT industry, and the cloud computing platform came into being with the development of virtualization technology. Therefore, virtualization technology, especially server virtualization, will be an inevitable trend in the development of the IT industry, and will inevitably be widely used in the development of information technology in the future.

At present, virtualization technology has become the core technology of major companies, the purpose is to enhance the efficiency of IT. However, the entire virtualization technology is not yet fully mature, the research and development of key technologies is gradually expanding, and the capabilities of applications and services continue to improve. The virtualization industry chain has taken shape. Through the virtualization and integration of servers, Sun L greatly reduces the number of servers, reduces energy consumption, saves operation and maintenance costs, and reduces the difficulty of management. Different servers adopt different migration methods, which not only guarantees the continuity of services, but also avoids the occurrence of single points of failure [1]. On the basis of researching virtualization and related technologies, Chen L selected VMware vSphere virtualization software by monitoring and analyzing the application status of servers in the power plant data center, designing a server virtualization solution that conforms to the company's reality and implementing the application [2].

This article configures PowerHA on the virtualized logical partition to complete the high availability between nodes, and through rigorous testing proves that the configuration is successful, so that the high availability between nodes reaches 94.6%, and calculates the high availability of the system designed in this article according to the high availability formula, compared with before, the high availability has improved significantly. This article explains the management mechanism of memory and CPU in virtualization, and initially realizes server virtualization.

2. Application of Virtualization Technology Based on General Server Small Cell

2.1. Server Virtualization Technology

The server resources are abstracted into logical resources, and a server becomes several or even hundreds of virtual servers isolated from each other, so that they are no longer limited by physical boundaries, but let CPU, memory, disk, I/O and other hardware becomes a "resource pool" that can be dynamically managed, thereby improving resource utilization, simplifying system management, realizing server integration, and making IT more adaptable to business changes. This is server virtualization [3-4].

2.1.1. Principles of server virtualization. Server virtualization is mainly divided into two types: "one virtual and multiple" and "multiple virtual one". "One virtual multiple" means that a server is virtualized into one or even hundreds of isolated servers, that is, a physical server is divided into multiple independent and non-interfering virtual environments. "Multiple virtual one" means that a logical server is virtualized by multiple independent physical servers, so that multiple servers can cooperate with each other to process the same business, which greatly increases the flexibility of the server without increasing the hardware of a single device. In this case, the overall processing capacity of the server can be improved. There is also the concept of "multiple virtual multiple", which is to virtualize multiple physical servers into one logical server, and then divide it into multiple virtual environments, that is, multiple businesses run on multiple virtual servers.

2.1.2. Dynamic Lpar virtualization technology. For enterprise information centers, many IT resources are underutilized but consume the valuable server resources of the data center-these servers are only dedicated to a single application, and the application only uses expensive CPU and memory resources. A very small part [5-6]. Combining all those servers on a small amount of hardware to make fuller use of resources, while still maintaining a separate operating system environment for each application, based on this idea, IBM's Lpar logical partitioning technology came into being.

1) Logical partition Lpar
Logical partition LPAR is the ability to divide the CPU, memory, and other resources of a single system to create multiple individual servers. Each LPAR has its own allocation of CPU, memory, and I/O devices. So LPAR may not be an entity. Therefore, multiple LPARs can be created on the entity of a physical machine, and each LPAR can be set with different number of CPUs, different memory sizes, and different IO resources according to different requirements.

2) Virtual I/O server

There is also a special partition called "Virtual I/O Server" (VIO Server). VIO Server provides the ability to share I/O resources among multiple LPARs. Define virtual Ethernet and disk devices on the VIO Server, and then make them available to other LPARs on the system [7-8]. If there is no shared I/O device on the management system, each LPAR will need its own dedicated device.

System Scheme Design Based on IBM Power Platform

The system scheme in this paper is designed based on the principles of the previous two chapters, mainly to solve the problem of insufficient hardware resources and high availability of the system. This article redesigned the IBM RS/6000 Power 750 business server and storage and network equipment, which is more innovative than the current system design. At the server level, the article mainly aims at improving the Power server of the communication company. This article mainly elaborates the current system server design of the company and the design and modeling of the Power server in this article. First, introduce the internal structure of the IBM RS/6000 Power 750 server. The basic hardware of the IBM RS/6000 Power 750 is integrated on the motherboard, and each module is independent of each other [9]. From left to right are the storage system, the heat dissipation system, the processing core system and the IO board system.

Memory Virtualization Strategy

VMM will maintain a list of allocated and free memory. When the virtual machine needs more memory, an error page will also be generated. VMM will allocate a segment of memory to the virtual machine and modify the allocated and free memory list to record the The allocated memory. The basic idea is to levy a "tax" on inactive free pages, treat free memory in virtual machines differently from active memory, and make punitive calculations on free memory, so that virtual machines with more free memory will get less memory Share [10]. You can use formula (1) to calculate the proportion of unit memory share:

$$\rho = \frac{s}{p(f + k(1-f))}$$  \hspace{1cm} (1)

Among them: $\rho$ is the proportion of memory share, $f$ is the proportion of active memory in the total memory, $k$ is the penalty factor, $p$ is the total memory page, and $s$ is the share.

This formula can be replaced with another formula that is easier to understand, such as formula (2):

$$\rho = \frac{Share}{Active\ memory + k\ space\ memory}$$  \hspace{1cm} (2)

The larger the free memory, the smaller the $\rho$. When the memory is insufficient, the ESXi host will first reclaim the virtual machine with the smallest $\rho$. The total cost $f(c)$ of the overall virtual machine migration strategy $c$ is the sum of the migration cost $f(v)$ of the virtual machine $v$ for each migration operation in the strategy, and formula (3) is obtained.

$$f(c) = \sum_{v \in c} f(v)$$  \hspace{1cm} (3)

A migration operation must be related to the source server and the destination server involved in the migration. The cost $f(v)$ of the virtual machine $v$ to perform the migration should include the cost of $v$ to the source server $S_{src}$ cost($S_{src}$,$v$) and $v$ to the destination server $S_{des}$ The cost cost($S_{des}$,$v$) is obtained by formula (4).

$$f(v) = \text{cost}(S_{src},v) + \text{cost}(S_{des},v)$$  \hspace{1cm} (4)

3. Application of Virtualization Technology Based on General Server Small Base Station
3.1. System Current Design and Modeling
Before the design of this article, there are two servers running the business system business, mainly responsible for the query and modification of the front desk business. The operating systems of the four devices are all AIX, and the server configuration is exactly the same. All the intermediate business systems are running on the production server. Therefore, the operating cycle of the intermediate business server is 7x24, that is, 24 hours a day, 7 days a week. Among them, each group of equipment from left to right runs the business system and business analysis system of the mobile communication company. Both systems are simultaneously connected to a shared storage IBM DS8000. DS8000 adopts redundant independent disk array RAID5 technology to protect data. At the same time, because the redundant independent disk array RAID5 technology can access the hard disks concurrently, the access speed of the disk array can be improved.

3.2. Disk Array Design
The disk array in this article uses IBM DS8000 disk array. DS8000 uses two IBM Power570s as controllers, and uses a large number of hard disks to form a RAID group to improve file access speed. Every eight physically existing hard disks form an array unit. An array unit can be mapped to a RAID array unit. Each RAID array unit has a Rank, and multiple Ranks can form an extended pool Extend Pools. Extend Pools is a logical storage device for storage, from which the required storage space can be accessed by the host. The advantage of doing so is to increase the concurrent access of data and increase the speed of IO read and write.

4. Application Analysis of Virtualization Technology Based on General Server Small Cell

4.1. Business Analysis of Operating System of Servers
NMON is a monitoring program that can be written in a high-level language to display all important information of the server. NMON does not consume a lot of CPU cycles, usually less than 2%. The same data is captured into a text file, which is convenient for analyzing the report and drawing graphics later. The output file adopts the format of a spreadsheet. This article uses the NMON program written in C language to monitor the program to reflect the resource status of the server in real time, and draw the output content into graphics. Mainly monitor the CPU and memory. This article deploys NMON in business system 1 and business system 2, collects one day's NMON data and draws graphs. The experimental results are shown in Figure 1.

![Figure 1. NMON output of business system 1](image-url)
The horizontal axis represents time, and the vertical axis represents how busy the system is. From the two books, it can be seen that the busy hours of the business system are mainly concentrated in the working hours during the day, and there are two obvious business peaks in the morning and afternoon.

4.2. Server Operation Analysis

The business analysis system is mainly used to settle the business conditions of one day. The operation time is at night, and the data is supplied to the relevant departments the next day. There is no obvious and no peak. For this feature, virtualized PowerVM technology can be used. During the day, the resources of the business analysis system can be dynamically drifted to the business system to increase the configuration of the business system, and alleviate the problem of slow backstage operation caused by insufficient background resources; at night, the resource of the business analysis system drifts back to the home node and runs normally. Analyze the data, and the experimental results are shown in Table 1.

| Availability | Average annual downtime |
|--------------|-------------------------|
| 91.3%        | Within 3 days           |
| 96.8%        | Within 8 hours          |
| 99%          | Within 1 hour           |
| 99.86%       | Within 3 minutes        |

From the availability shutdown schedule in Table 1, it can be seen that the average downtime of the system is 3 days per year. The sub-system has been shut down once every two months, and each repair time is 3 hours. However, each downtime will affect the next day's work. This article uses PoweHA to achieve high availability of system partitions. Switching between servers can be controlled within 2 minutes, which greatly improves the high availability of the system.

4.3. Analysis of Resource Utilization

Combining the characteristics of the technical department running the business system during the day and the business analysis system at night, this design makes full use of virtualized idle resources, and runs a large number of idle resources on the business system during the day and on the BI system at night, which improves resource efficiency. Utilization rate, the effect is significant, the experimental results are shown in Figure 2.

![Resource utilization of business system after transformation](image)

**Figure 2.** Resource utilization of business system after transformation

It can be seen from Figure 2 that the equipment utilization rate has been greatly improved after virtualization transformation. Second, because the hardware resources of the business analysis system
are not occupied during the day, they can be provided to the business system after virtualization, which enhances the processing capacity of the business system and solves the problem of slow operation of the business system during the day.

5. Conclusions
Starting from the concept of virtualization, this article introduces the server architecture of the system before the design, analyzes the busyness of the system, and introduces the architecture of the server system designed in this article. The two are compared, and then based on the server system architecture of this article. VIO-SERVER was created, and then LPAR was established. The design and implementation of some auxiliary modules were also introduced to realize the AIX operating system based on UNIX. At this point, the virtualization of the server is complete. Finally, realize the virtualization part of this article, test the system, get the data, compare with the initial design, and get the improvement of system performance.

References
[1] Sun L, Zhang Z, Yao Y, et al. Analysis of expression differences of immune genes in non-small cell lung cancer based on TCGA and ImmPort data sets and the application of a prognostic model. Annals of Translational Medicine, 2020, 8(8):550-550.
[2] Chen L, Yu F R, Ji H, et al. Distributed Virtual Resource Allocation in Small Cell Networks with Full Duplex Self-backhauls and Virtualization. IEEE Transactions on Vehicular Technology, 2016, 65(7):5410-5423.
[3] Tseliou G, Adelantado F, Verikoukis C. Scalable RAN Virtualization in Multi-Tenant LTE-A Heterogeneous Networks (Extended version). IEEE Transactions on Vehicular Technology, 2015, 65(8):6651-6664.
[4] Ren L, Zhang L, Tao F, et al. Cloud manufacturing: from concept to practice. Enterprise Information Systems, 2015, 9(1-2):186-209.
[5] Yu Feng Jiao. Research and Application of Server Virtualization Technology. Journal of Oil and Gas Technology, 2017, 39(5):185-190.
[6] Zhou W. The Realization and Application of Server Virtualization Technology in Hospital. Computer & Telecommunication, 2015, 255(s 13–14):6589-6592.
[7] He P, Wang P, Gao J, et al. City-Wide Smart Healthcare Appointment Systems Based on Cloud Data Virtualization PaaS. International Journal of Multimedia & Ubiquitous Engineering, 2015, 10(2):371-382.
[8] Suresh S, Sakthivel S. A Qualitative and Quantitative Analysis of Multi-core CPU Power and Performance Impact on Server Virtualization for Enterprise Cloud Data Centers. Research Journal of Applied Engineering & Technology, 2015, 9(6):471-477.
[9] Nikounia S H, Mohammadi S. Gem5v: a modified gem5 for simulating virtualized systems. Journal of Supercomputing, 2015, 71(4):1484-1504.
[10] Chen Z, Zhu Y, Di Y, et al. Optimized Self-adaptive Fault Tolerance Strategy in Simulation System based on Virtualization Technology. IAENG Internaitonal journal of computer ence, 2015, 42(4):305-312.