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修士論文

A Study on Dynamic Performance Provisioning in Storage Virtualization Facility

ストレージ仮想化機構における動的性能プロビジョニングに関する研究

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指導教官　喜連川　優　教授

学籍番号：　46423

喜連川研究室　　陶　意非

東京大学大学院　情報理工学系研究科

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A Study on Dynamic Performance Provisioning in Storage Virtualization Facility

By

Yifei Tao

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Chapter 1: Motivation

Now storage is more and more important, not only just as an equipment connecting to the server, but also as a special independence one. So there is a big need for storage.

1.1 The Increase of Data Capacity

With the data-wear houses what can hold data in chronological order or the applications what can save the huge data like big WWW systems, the data capacity in the enterprise system is increasing in a high rate of 70% per every year. All the data capacity is closing to PByte's world rather than TByte's. One reason is because the increase of streaming service with the broadband spread. And because the open systems are usually used for the data-wear house and WWW systems while a main frame is used for the conventional systems like the banking on-line system, the increase of the open systems' capacity is so high that the amount of the open systems' capacity is more than the main frame's.

Holding more data in data-wear house, enabling to analysis more details on corporate strategy and marketing on the customers, increasing the spread of broadband, make the increasing of data capacity will go on for a long time. The improvement of magnetic recording technology makes the rapid increasing of data capacity come true. In 1990, the aspect packing density was 100Mbit/inch^2, while after 10 years; in 2000 it was 20Gbit/inch^2, 200 times as 1990's. For this technology improvement, the hard disk capacity is increasing 1.5 times every year from 1980. And because the price per capacity is deceasing in the same rate, the price of hard disk is not changed that makes a great contribute.

1.2 The Big Increase of Management Cost

With the increase of data capacity in system, the data's backup and to add the storage for corresponding to the capacity change will be a big burden on the management.

With the traditional methods, in which the storage was just one device connecting to the server and in the control of server (direct touch storage), if we want to control the data over the size of terabyte, most of dispersed storages need different management for connecting to different operation systems and cause a big cost. In one research, it is said that the cost of managing the storage is 8 times comparing to the cost of purchasing the storage equipment. What means, comparing to the price of the storage equipment, it would take much more money to backup data or other management. Because in direct touch storage, the ways to manage the storages are different adaptation to different operation systems, the administrators have to master different operation system if there are many different operation systems. So more administrators are needed and it causes much higher cost.

1.3 Some Solutions

For these reasons above, storage consolidation what means consolidates the dispread storages into large storage equipment with multiple ports for connecting to servers and connects to the servers via special network for high performance storages (Storage Area Network: SAN) are commonly used to management the data together so that can reduce the cost for management. With consolidation, comparing to the tranditional method – using different management way for different server platforms, we are able to unify the management way. And about the capacity management also could be a high efficiency because the used pools of volume could be used by multiple servers.

Using a SAN and the new storage management method, etc is for the goal about getting a high efficiency to manage larger and larger data and cutting down the cost for making use of data. Now for the compute system, cutting down the cos is a main project. So many new methods are proposed as solution.

Comparing to SAN, NAS (Network Attached Storage), who's the main character is having the file system function at storage side so different kinds of servers would access the same files, is increasing the share. NAS formally was proposed for sharing files to develop large software from 1980, but now

it is using for sharing files between UNIX and Window systems, holding WWW servers' contents and the data of CAD system. In most case of the server-client system, UNIX system with high reliability is used as server while Window system with better cost is used as client. So if NAS is used, Window system client would access the UNIX system server just like access Window system server even though without installing something special. More, as exclusive file sharing system, NAS can be introduced easily. And unlike SAN has to construct new network with FC (Fibre Channel), NAS can be introduced with exist IP network. So with above advantage, NAS is increasing the share.

About other approach for cutting down the storage management cost, there are some out sourcing using iDC (Internet Data Center) and SSP (Storage Service Provider). iDC provides the service incluing the hosting of Web server, and sometime is used for making use of ASP (Application Service Provider) systems. SSP is making use of SAN to provide the high reality storage service with completely backup. For the user, they can get the advantage of SAN without constructing Fibre Channel network is a big point. Now SSP are mainly used to provide the user who constructed large SAN with existed site or contracted iDC site capacity by a defined price per capacity every month. But, comparing to the storage hardware, the management price above is surely higher, so there is a new way of SSP, what is taking on making use of the storage of user's site.

Comparing with storage consolidation consolidating the storages in physically, the technology named *storage virtualization* what means managing all dispersed storages as storage pool and defining virtualized volume from the pool as provide servers' request is more and more attracted considerable attention. Such a virtualization facility enables resource provisioning of the storage system. Many space provisioning methods are already proposed discussed, but performance provisioning is not much discussed. We developed dynamic performance provisioning for virtualized storage environment, which can add additional disk drives and change the allocation policy to absorb the rapid workload change. This paper describes the design of the provisioning facility and shows trace-based performance evaluation.

The remainder of this paper is organized into 4 sections. Section 2 reviews the trend of storage technology, the related work and introduces some commonly used provisioning productions and service. Section 3 introduces the dynamic performance provisioning proposed by us. Section 4 will show the trace-based performance evaluation. And section 5 will make a conclusion and the feature work.