Hitachi Storage Solution for Cloud Computing
—Hitachi Virtual Storage Platform—

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OVERVIEW: With growing interest in cloud computing driven by major changes in the business environment in recent years, high hopes are being placed on storage virtualization as a technology that can help realize the cloud. Hitachi has led its competitors by releasing a range of different storage virtualization technologies for enterprise use. Hitachi Virtual Storage Platform announced in September 2010 was the first to provide virtualization of tiered storage and features an advanced architecture that allows its configuration to be expanded flexibly. It can be used to configure cloud systems with the high levels of flexibility, reliability, and performance to respond promptly to business changes.

INTRODUCTION

THE amount of data handled within companies has been growing rapidly in recent years against a background in which increased use is being made of documents, images, video, and other forms of unstructured data. Steps are needed to cope with these data volumes, which are set to keep on increasing. Moreover, with the economic recession driving down IT (information technology) budgets, finding ways of managing these growing data volumes efficiently and at low cost has becoming increasingly important. Therefore, many companies have become interested in cloud computing as a way of overcoming these challenges, and growing expectations are being placed on storage virtualization as one of the technologies for achieving this.
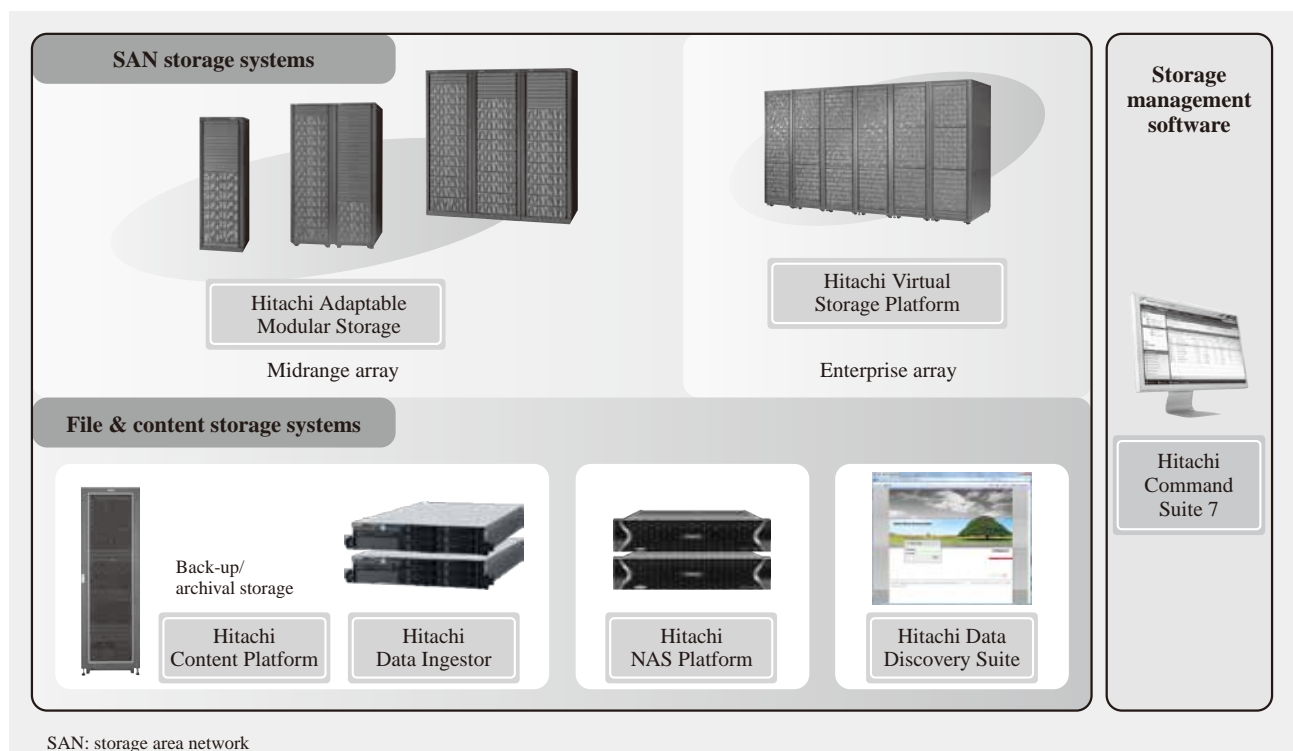

Fig. 1—Hitachi's Portfolio of Storage Solutions.
Hitachi supplies total solutions that extend from disk arrays suitable for a wide range of business sectors to administration software and services.

Hitachi has led its competitors in releasing storage virtualization technologies that have succeeded in lightening the workload of storage administrators and helped make effective use of resources. They are extending from disk arrays to administration software and services that are suitable for a wide range of industry sectors, and capable of being adapted to different sized customer businesses. These storage virtualization technologies can be used to build cloud systems that can keep up with changing business conditions (see Fig. 1).

Hitachi announced its Hitachi Virtual Storage Platform enterprise disk array system in September 2010. With high reliability, performance, and scalability, Hitachi Virtual Storage Platform is the ideal virtual storage system for the cloud. It features a newly developed virtualization function for tiered storage that improved cost performance beyond what was possible in the past by automatically allocating data, based on frequency of access, to one of a number of storage tiers, each with different characteristics. Also, users are able to start out small, because the platform can be expanded when needed to satisfy performance and capacity requirements, flexibly and without shutting down the system. The platform also considers the environment, saving energy by using 2.5-inch flash drives and SATA (Serial Advanced Technology Attachment) drives.

This article describes the Hitachi Virtual Storage Platform storage solution for cloud computing.

USING VIRTUALIZATION TO ACHIEVE EFFICIENT STORAGE UTILIZATION

Hitachi's storage products reduce the workload of the storage administrator and make effective use of resources thanks to proprietary virtualization technologies that Hitachi has released ahead of its competitors (see Fig. 2).

Hitachi Universal Volume Manager provided virtualization of storage devices in 2004. The product integrated external disk arrays so that they appeared like a single virtual storage device that could be administered as a single unit. Because it permitted the connection of a wide range of storage systems, including those from other vendors, it was able to perform the complex processing associated with transferring data from other vendor's storage devices in a way that maintained processing performance and did not required the system to shut down.

Hitachi Dynamic Provisioning released in 2007 added virtualization of storage capacity. This allowed the virtual storage capacity allocated to host servers to be larger than the actual physical capacity, reduced the amount of work required for data volume capacity design, and significantly reduced the frequency of
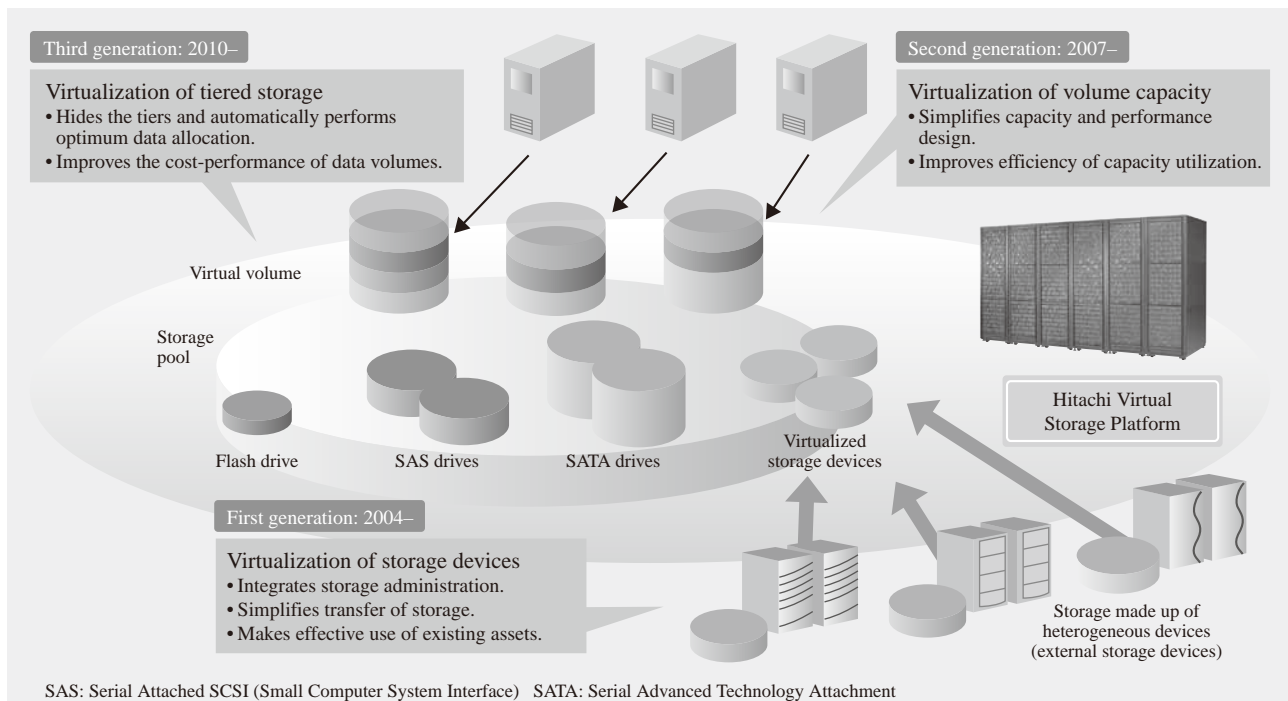

Fig. 2—Hitachi's Storage Virtualization Functions.
In addition to existing functions for virtualization of storage devices and data volume size, Hitachi Virtual Storage Platform also provides virtualization of tiered storage.

configuration changes, system shutdowns, and other interruptions needed when expanding data volume capacity. Because data volumes were able to be configured flexibly, without having to allow for the physical configuration, this also allowed investment in storage to be optimized and increased storage resource utilization, including for external disk arrays connected virtually. To these existing storage virtualization functions, the latest release (Hitachi Virtual Storage Platform) has added the advanced Hitachi Dynamic Tiering function, which allows virtualization of tiered storage.

In addition to high-performance SAS [Serial Attached SCSI (Small Computer System Interface)] drives, recent years have seen a diversification in the storage tiers available for storing different types of data. These include flash drives that offer even faster data access, SATA drives with large capacity and lower cost per bit, and externally connected heterogeneous storage. On systems that combine a variety of different storage media, it is important that data is stored on the appropriate medium for its characteristics, but this data allocation process is difficult for administrators to manage manually.

Hitachi Dynamic Tiering divides data using a finer level of organization than data volumes and automatically performs optimum allocation of data to the various storage tiers (each with different characteristics) based on how frequently the data is accessed. This minimizes the workload

associated with system configuration and operation by significantly reducing tasks such as data management and performance design that previously needed to take account of the storage tiers. The synergies that arise from combining all of these virtualization functions on a single platform allow the TCO (total cost of ownership) to be cut by even more than was possible in the past.

One of the difficulties with virtualization is that, because it hides the physical layer, it can be difficult to identify the location of the problem in the event of performance degradation or other fault. Hitachi storage systems, in contrast, are easier to fix because they highlight the problem location when a fault occurs. Also, the Tuning Manager operational management software for storage systems provides integrated management of an entire storage network.

NEW HARDWARE ARCHITECTURES FOR CLOUD SYSTEMS

In addition to automation and virtualization, cloud systems also require a flexible storage configuration. In response, Hitachi Virtual Storage Platform has adopted a world-first "3D scaling architecture." The architecture allows the system to be "scaled up," "scaled out," or "scaled deep" to extend performance and capacity flexibly in line with business growth.

Scaling up allows the processors, ports, caches, HDDs (hard disk drives) and other components of storage devices to be added to, or upgraded independently, in order to expand capacity or otherwise improve performance.

Scaling out improves the return on investment in systems that require high performance and large capacity, such as at large data centers or mission-critical systems in the finance industry by linking together the dual controllers that handle the operation of a storage device to form a single system.

Scaling deep, meanwhile, allows the connection of heterogeneous storage devices as described earlier. Unstructured data such as video or e-mail is rapidly growing in quantity. Because different types of storage devices (including models from other vendors), totaling up to 255 Pbyte of addition storage capacity, can be connected to a single Hitachi Virtual Storage Platform, this approach is suitable for storing large amounts of this data. This provides a storage system suitable for new or growing businesses, and delivers a good return on investment because it allows a small system to be installed initially, and then progressively expanded in step with business growth (see Fig. 3).
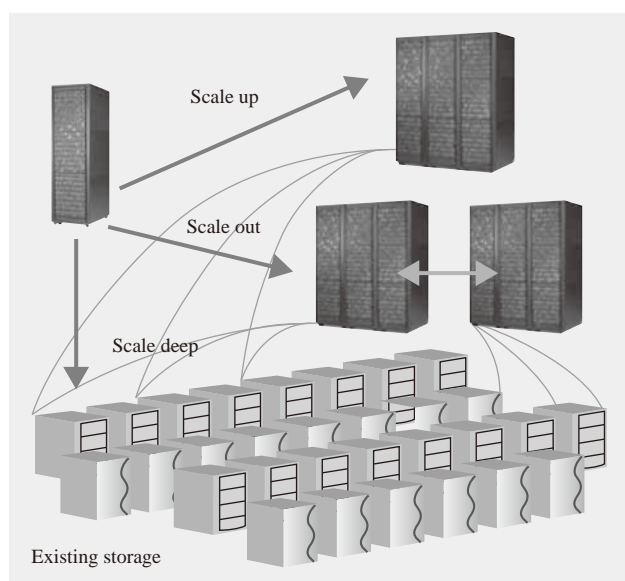

Fig. 3—3D Scaling Architecture.
A 3D scaling architecture allows for flexible expansion of the storage configuration.
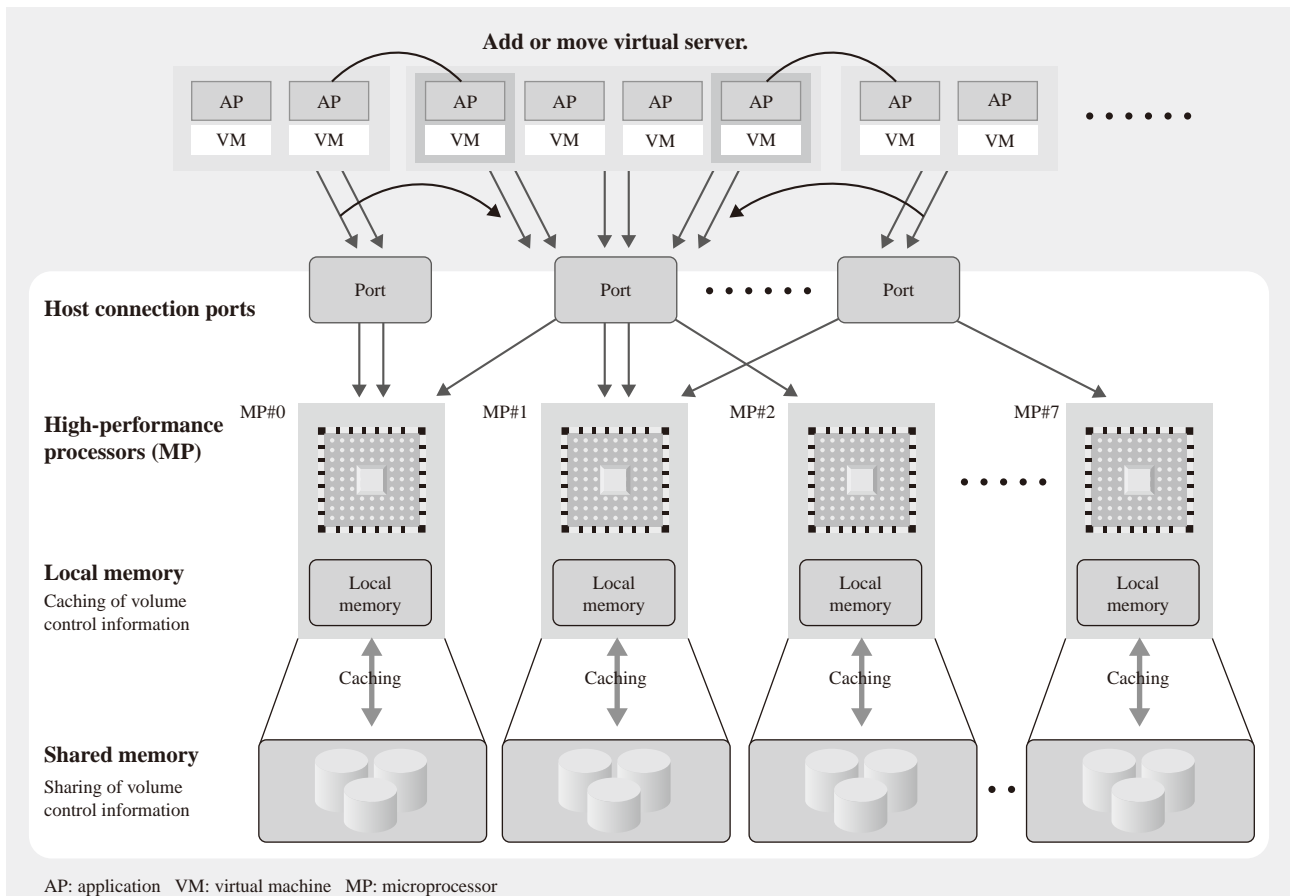
Fig. 4—New Controller Architecture.
The architecture can maintain a stable and high level of performance even when sudden changes occur in the storage system workload.

Furthermore, Hitachi storage systems have long had a fully replicated configuration at the hardware component level and provide a high level of availability even if a fault occurs in order to minimize the impact on the workload of the host server. The new Hitachi Virtual Storage Platform maintains the existing architecture, which was designed for high reliability and availability, but has also virtualized the processor resources in the controller so that the data access load can be spread across multiple processors based on changing server workloads.

Server virtualization is becoming more common as the number of cloud systems increases. In a server virtualization environment, workload on the storage system can vary suddenly due to changes, such as adding or moving virtual servers. Because Hitachi Virtual Storage Platform can even out the quantity of data processed by the processors in a controller, a stable and high level of processing performance can be maintained even in situations such as when writing of data is concentrated on a particular port, or when being connected to virtual servers for which it is difficult to predict the access load (see Fig. 4).

Improving power consumption and saving on space are also important factors in coping with the ever increasing quantities of data. In addition to the existing 3.5-inch flash drives and SATA drives, Hitachi Virtual Storage Platform also supports the use of 2.5-inch flash drives and SAS drives, which are smaller and offer better power consumption. When using 2.5-inch drives, a disk array system can mount up to 2,048 drives. Compared to previous models, this cuts down on both power consumption and space.

CONCLUSIONS

This article has described the Hitachi Virtual Storage Platform storage solution for cloud computing.

Hitachi Virtual Storage Platform takes advantage of Hitachi's proprietary virtualization functions, hardware architecture, and other features to combine a high level of flexibility, reliability, and performance and supports the configuration of cloud systems that can respond promptly to business changes. Through these measures, Hitachi intends to help boost corporate competitiveness by improving customer business continuity, making effective use of data, and reducing TCO.

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