"Hitachi Universal Storage Platform V" and "Hitachi Universal Storage Platform VM," the Enterprise Disk Array with Enhanced Storage Virtualization

Keitaro Ikejiri
Masataka Innan
Hidehiro Nagaya
Yasuyuki Nagasoe

OVERVIEW: The disk array subsystem for enterprise systems "Hitachi Universal Storage Platform V" and its corresponding entry-model "Hitachi Universal Storage Platform VM" are equipped with advanced virtualization and high-reliability data-replication functions, thereby further improving the effectiveness of capital investment in storage. The capacity virtualization function "Hitachi Dynamic Provisioning" — fitted for the first time in the world at enterprise class — does not require complex volume (i.e. storage capacity) design and raises the utilization efficiency of storage capacity. Connecting this function with "Hitachi Universal Volume Manager," even in the case of storage connected to an external disk array subsystem makes it possible to more effectively utilize unused disk capacity and dramatically simplify integration of management and operation.

INTRODUCTION

AS the "information society" advances, all information is being digitized and exchanged back and forth. As for corporations, the volume of data that handles, for example, business transactions, is increasing. Moreover, because the storage infrastructure for storing this data is growing, and managing it is getting more complicated, increase in TCO (total cost of ownership) is becoming a major concern. Given this situation, in regard to storage systems, the management and operational costs of storage infrastructure, as well as its running cost, must be reduced.

To meet these needs, Hitachi, Ltd. has formulated a concept for integrated storage solutions called "Services Oriented Storage Solutions" — which place emphasis on customer operations and realize effective utilization of storage resources, even if customers themselves are unaware of the complex system configuration. As products based on this concept, "Hitachi Universal Storage Platform V" (a disk array subsystem for enterprise systems) was launched in May 2007, and "Hitachi Universal Storage Platform VM" — realizing all the advanced virtualization functions provided by Hitachi Universal Storage Platform V by means of a 10-U (where 1 U = 44.45 mm) compact controller (which fits in a standard 19-inch rack) — was launched in September 2007.
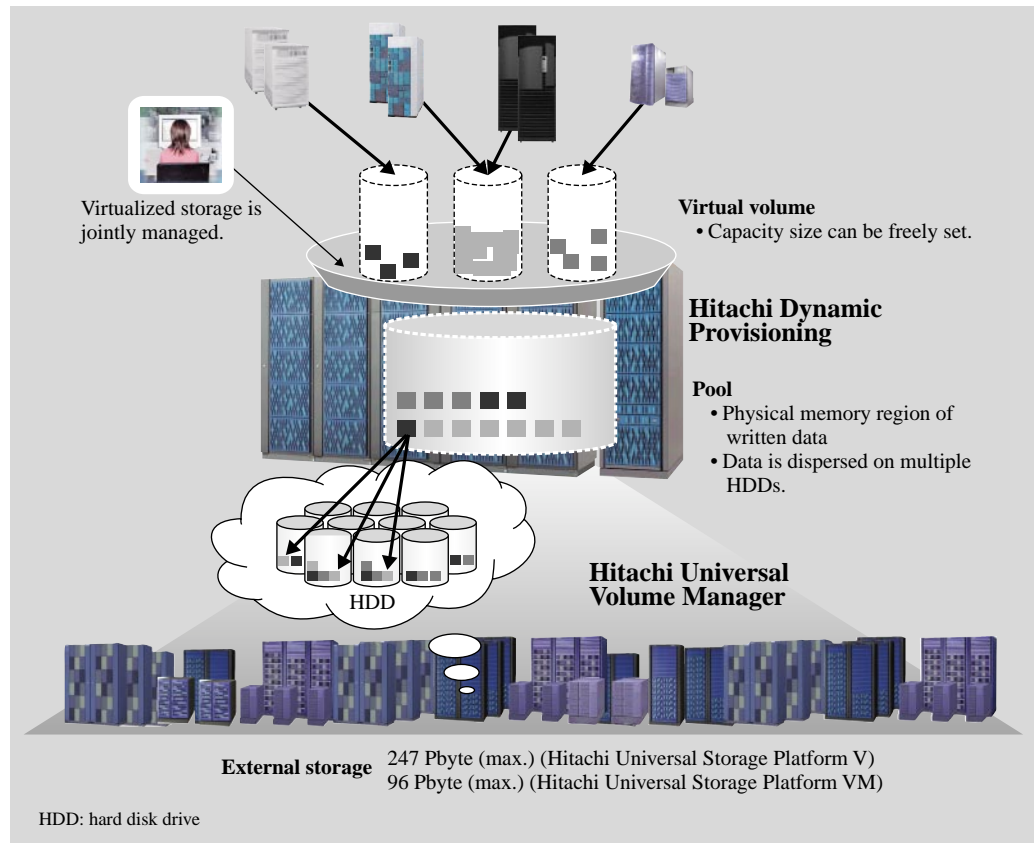
After that, in November 2007, regarding Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM, along with expanding the application range of "Hitachi Dynamic Provisioning" to take in external storage, strengthening of their functions was carried out so that a large-capacity (750 Gbyte) disk drive, called a "SATA (serial advanced technology attachment) disk drive," could be supported.

As one actual product, the virtualization controller (the total shipment of which reached 7,300 units across the world up to September 2007) provides a variety of functions for handling different challenges facing users and has been highly appraised by the market.

In the rest of this report, first, the advanced functions of Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM, and the hardware that underpins them, are described. After that, some tangible results of introducing these products are presented.

ADVANCED FUNCTIONS PROVIDED BY HITACHI UNIVERSAL STORAGE PLATFORM V AND HITACHI UNIVERSAL STORAGE PLATFORM VM

As the world's first enterprise-class mounted volume (i.e. capacity) virtualization function, "Hitachi Dynamic Provisioning" can define a large volume (i.e.

Fig. 1—Developed Virtualization Function. Because the Hitachi Dynamic Provisioning function provided on Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM can even be applied to storage connected externally, the effectiveness of capital investment in storage regarding the whole storage infrastructure of a data center and storage-utilization ratio can both be improved.

"virtual volume") and simplify capacity design of storage without depending on physical capacity of storage. Moreover, with this function, it is possible to extend real storage area (when it is insufficient for actual data) by adding disk drives as needed without having to shutdown the system, not by introducing a disk drive appropriate for forecasted future capacity usage in the conventional manner. Consequently, it becomes possible to cut initial installation cost as well as power and air-conditioning costs. What's more, since Hitachi Dynamic Provisioning distributes data between multiple disk drives, it achieves stable performance, in an environment in which load fluctuates with each service, without the need for a complex design.

Furthermore, by expanding the application range of Hitachi Dynamic Provisioning to cover external storage virtually integrated by means of a storage-device virtualization function called "Hitachi Universal Volume Manager," effective utilization of unused disk capacity of storage at all data centers becomes possible. And these functions can be managed and operated in an integrated fashion by means of Hitachi storage-management software. Consequently, the result of

capital investment in storage (regarding the entire infrastructure for storage at data centers) and the efficiency of storage utilization have been improved (see Fig. 1).

HARDWARE OF HITACHI UNIVERSAL STORAGE PLATFORM V AND HITACHI UNIVERSAL STORAGE PLATFORM VM
Features of Hardware

The advanced hardware of Hitachi Universal Storage Platform V, which supports various sophisticated functions, has significantly improved performance, compared to the conventional Hitachi Universal Storage Platform, to reach the world's highest class. Hitachi Universal Storage Platform V recorded the world's highest performance for a single enterprise system (as of 1st October, 2007), namely, 200,245.73 SPC IOPS (where IOPS is number of inputs/outputs per second) against the SPC-1 benchmark results of the Storage Performance Council.

Adopting the same architecture as Hitachi Universal Storage Platform V, Hitachi Universal Storage Platform VM realizes all the functions of

Advance functions of Hitachi Universal Storage Platform V are all supported.

Scalability
- Maximum subsystem on-board capacity: 177 Tbyte
- Through Hitachi Universal Volume Manager, a maximum external-storage capacity of 96 Pbyte is jointly managed.

Connectivity
- Fibre Channels: maximum of 48 ports
- Mainframe Fibre Channels: maximum of 24 ports
- Mainframe serial channels: maximum of 24 ports

High reliability
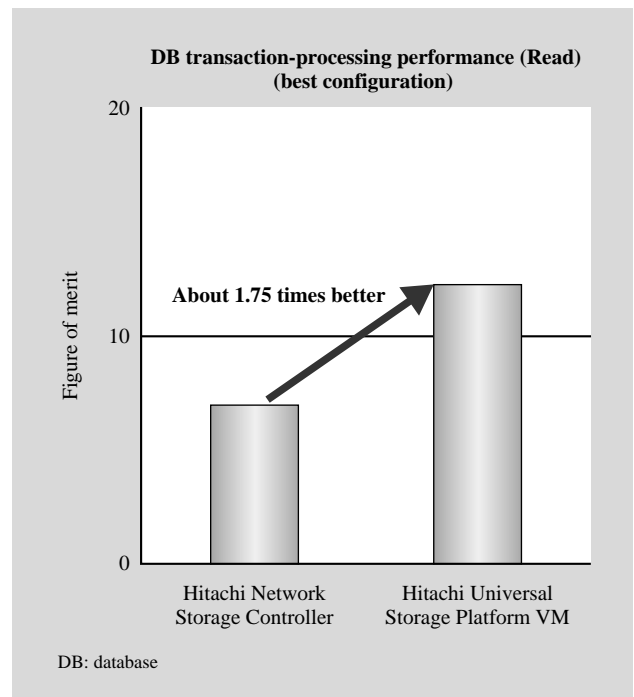Component duplexing, redundancy, no-stoppage maintenance

Fig. 2—Features of Hitachi Universal Storage Platform VM. Having the advanced functions of Hitachi Universal Storage Platform V, Hitachi Universal Storage Platform VM simultaneously strengthens scalability and connectibility.

Hitachi Universal Storage Platform V by means of a 10-U compact controller (see Fig. 2). Moreover, with Hitachi Universal Storage Platform VM, installation of the disk-array-controller unit only is possible. In this manner, while enough disk capacity is retained, introduction of the virtualization and data-replication functions provided by Hitachi Universal Storage Platform VM into an existing storage environment (with functions for natural-disaster countermeasures, integrated management, etc.) becomes easy.

In regard to the hardware performance, drive-transfer speed and processing speed are both about double the corresponding values for conventional equipment, i.e. a Hitachi Network Storage Controller. Consequently, transaction performance is improved by 1.75 times, compared to the conventional performance (see Fig. 3). Furthermore, positioning "load-balance" technology between processors mounted on Hitachi Universal Storage Platform V makes it possible to simplify performance design to handle load balance (which fluctuates according to time and application). In addition, Hitachi Universal Storage Platform VM contributes to reducing power consumption by 15% (when 120 disk-drive units are mounted), compared with that of conventional equipment, and lowering running costs of storage systems.

Fig. 3—Comparison of DB Transaction Capability of Conventional Machine (Hitachi Network Storage Controller) and Hitachi Universal Storage Platform VM.
Hitachi Universal Storage Platform VM achieves approximately 1.75 times better transaction performance than a conventional controller.

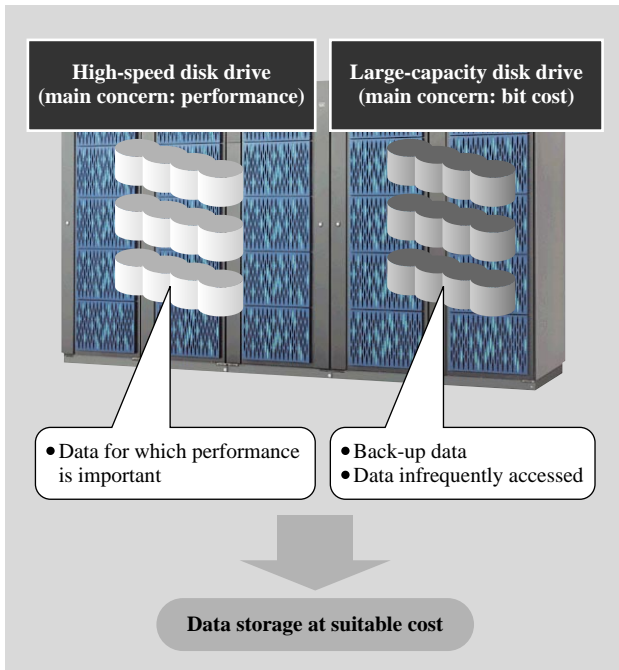### Extension of Capacity Scalability

Supporting a large-capacity disk drive whose significant concern is bit cost made it possible to extend capacity scalability. For example, by utilizing a disk drive with large capacity of 750 Gbyte, Hitachi Universal Storage Platform V can load up to 850 Tbyte, and Hitachi Universal Storage Platform VM can load up to 177 Tbyte.

For this large-capacity disk drive as well, all functions for "open systems" (including Hitachi Dynamic Provisioning and Universal Volume Manager of Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM) are applicable.

Fig. 4—Expansion of Capacity Scalability by Means of High-capacity Disk Drive.
By making use of a large-capacity disk drive whose significant concern is bit cost, scalability can be expanded and data-storage cost can be reduced.

Moreover, this disk drive enables mixed loading with other disk drives on subsystems. As a result, it can cut data-storage costs by means of storing data whose main concern is performance on a high-performance disk drive and storing back-up data and data whose access frequency is low on a large-capacity disk drive (see

Fig. 4).

RESULTS OF INSTALLING HITACHI UNIVERSAL STORAGE PLATFORM V

This section describes the cost-reduction effect achieved by introducing Hitachi Universal Storage Platform V. According to an estimation by ITCentrix, Inc. [a US consultancy for measuring effects of IT (information technology) investment], in the case of users who possess a total storage capacity of 70 Tbyte and want to accommodate future conceivable increases in data volume by introducing new storage and using it for three years, if they install Hitachi Universal Storage Platform V, TCO related to storage will be reduced by 39% in comparison with the respective TCO for another company's system (see Fig. 5). The two points described below are the main factors contributing to this cost-reduction effect.

(1) Through its various functions such as virtualization and data-replication, Hitachi Universal Storage Platform V makes possible unified management and operation of a system environment in which multiple servers and existing storage systems are widely distributed. As a result, management and operational costs are reduced through substantial simplification of operation and management of storage (such as back-up and volume-capacity design and performance tuning).

(2) Through Hitachi Dynamic Provisioning, utilization efficiency of internal and external storage of Hitachi Universal Storage Platform V is improved and storage-installation cost is cut dramatically.

Fig. 5—Comparison of Storage TCO (total cost of ownership) for Three Years.
As a result of introducing Hitachi Universal Storage Platform V, storage-related TCO can be reduced by about 39% [estimated by ITCentrix, Inc.(US consultancy)].
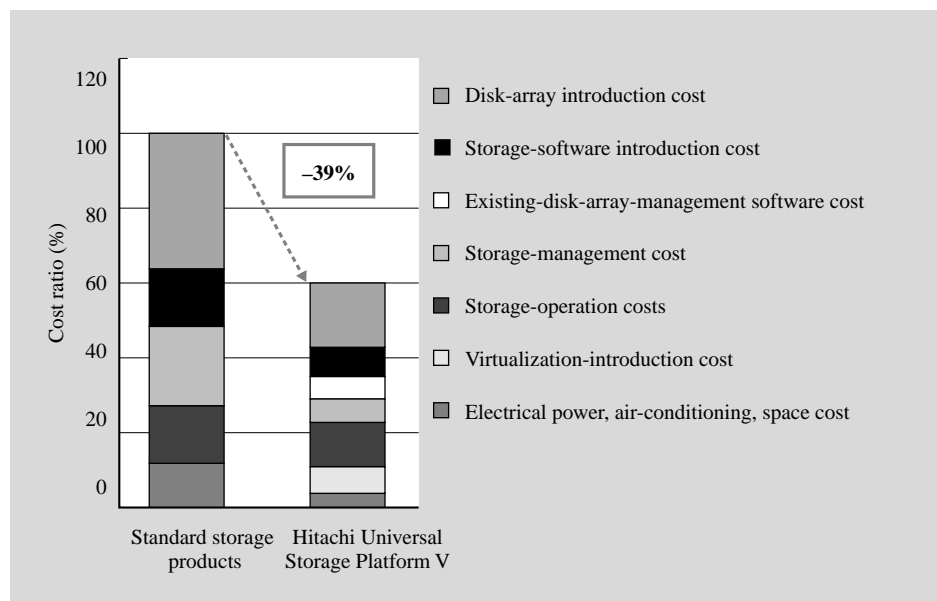
CONCLUSIONS

The main features of Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM — both core products among storage solutions provided by Hitachi — were described, and the key result of installing them (in terms of a performance comparison) was presented.

As a "total storage solution provider," from here on Hitachi, Ltd. intends to continue providing optimized integrated storage tailored to customer operations. On top of that, we will push ahead with strengthening of platforms based on our "Services Oriented Storage Solutions" and continue to establish systems with high compatibility for underpinning strategic applications of information.

REFERENCES

(1) M. Innan et al., "Hitachi Universal Storage Platform V" Brings New Dimension of Storage Virtualization," *Hitachi Hyoron* **89**, pp. 568-571 (July 2007) in Japanese.
(2) "Hitachi Storage Solutions," http://www.hitachi.co.jp/storage/ in Japanese.

ABOUT THE AUTHORS

Keitaro Ikejiri
Joined Hitachi, Ltd. in 2007, and now works at the Product Planning Department, the Disk Array Systems Division, the Information & Telecommunication Systems. He is currently engaged in the product planning of enterprise disk array systems.

Masataka Innan
Joined Hitachi, Ltd. in 1999, and now works at the Product Planning Department, the Disk Array Systems Division, the Information & Telecommunication Systems. He is currently engaged in the product planning of enterprise disk array systems.

Hidehiro Nagaya
Joined Hitachi, Ltd. in 1991, and now works at the Disk Array Hardware Development Department, the Disk Array Systems Division, the Information & Telecommunication Systems. He is currently engaged in the development of enterprise disk array system hardware.

Yasuyuki Nagasoe
Joined Hitachi, Ltd. in 1994, and now works at the Disk Array Software Development Department I, the Disk Array Systems Division, the Information & Telecommunication Systems. He is currently engaged in the development of enterprise disk array system software.