Integrated Platform "SIGMAGRID" Commercialized

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Abstract

The "virtualization" and "integration" technologies are attracting attention and noticeable attempts are being made for the most effective, most flexible utilization of IT resources using these technologies. This paper introduces the "SIGMAGRID," a next-generation integrated platform featuring an original virtualization technology that was released in October 2005. This paper specifically focuses on the background of the introduction, the key technologies supporting the SIGMAGRID and the innovative features of the platform.

Keywords

virtualization, server integration, storage integration, operation management, business grid

1. Introduction

The next generation integrated platform, "SIGMAGRID" consists of a group of platforms for providing an integrated system to enable an optimum distribution of IT resources. It modularizes multiple servers that form a server system and various devices including network and I/O devices. All of these are packaged in an intelligent rack called the "SIGMAFRAME" and they are managed in an integrated manner by virtualizing them with the aid of an integrated management middleware called "SigmaSystemCenter." In the following, the authors introduce an outline description of SIGMAGRID, the key technologies supporting it and examples of its applications.

2. SIGMAGRID

At present, many customers have the problem of "complicating and dispersing environments and the resulting increase in TCO" in their system environments. To solve such problems in corporate systems and achieve overall optimization by integration and reconciliation, NEC has developed the next-generation integrated platform "SIGMAGRID." "SIGMA" derives from integration, "GRID" derives from the grid computing that distributes resources dynamically using advanced virtualization technology, and "SIGMAGRID" has the meaning of "optimizing IT resources by integration."

The SIGMAGRID is composed of modules that are categorized and virtualized according to their functions such as; the "server modules," "network modules," "I/O modules," the intelligent rack "SIGMAFRAME" for accommodating the modules and the integrated management middleware "SigmaSystemCenter." It is an integrated platform providing a server/storage/network convergence technology based on NEC's platform technology "VALUMO."

Introduction of the SIGMAGRID facilitates the integration and concentration of the servers in a multi-platform environment including multiple OSs such as Linux, Windows and HP-UX, high-performance, high-reliability 64-bit Intel Itanium 2 processors and highly flexible 64-bit Intel Xeon processors.

(1) Intelligent Rack "SIGMAFRAME"

Photo shows the external view of the SIGMAFRAME.

The intelligent rack "SIGMAFRAME" accommodates the server modules, management modules, LAN switch modules, pass-through modules, I/O modules and power supply boxes. The modules are interconnected via the high-speed "Sigma Highways" using a plug-in construction, thereby making it possible to easily extend and maintain the system. Each module can be installed in a dual redundancy system for higher availability.

The SIGMAFRAME can also accommodate up to 16 units of the rack-mount type "Express 5800/120Rf-1" IA-32 servers.

Up to two management modules can be installed in the SIGMAFRAME for use in managing all of the modules in the rack. Their functions include surveillance of the module status, detection of system modifications and faults, and system reconstruction. They are also capable of an automatic reconfiguration of the LAN switch modules and setup for the PCI-EXPRESS switches of the I/O modules.

Photo External view of the SIGMAFRAME.

Up to two LAN switch modules can be installed in the rack to enable high-speed switching between the servers in the rack as well as between them and an external LAN. The area for use in accommodating the LAN switch modules can also accommodate either the LAN switch modules or the pass-through modules.

The number of pass-through modules that can be installed is also two at maximum. These modules do not feature a switching function but access the LAN ports output from the server modules at the front of the SIGMAFRAME.

Up to two I/O modules can also be installed for a concentrated installation of the PCI slots, which are separated from the server modules, via PCI-EXPRESS switches. Each I/O module can accommodate up to 16 HBA fiber channels.

Up to two power supply boxes can also be installed to feed and control the power supply to the modules in the rack.

(2) Integrated Management Middleware "SigmaSystemCenter"

Integrated management middleware "SigmaSystemCenter" is software that concentrates all of the functions required for the integrated platform management based on NEC's virtualization and autonomous technologies that have been developed alongside of the VALUMOware. The system provides flexible management functions for making full use of the advanced functions and performances of the SIGMAFRAME as well as a high availability based on multi-OS compatibility, optimum resource deployment according to processing performance requirements and high autonomy.

When a server module is inserted in a slot of the SIGMAFRAME, the management module detects it and reflects it in the physical configuration information managed by the SigmaSystemCenter. The system administrator who uses the management server that is connected to the SIGMAGRID through the network can access the management module thanks to the SigmaSystemCenter and confirm the physical configuration of the SIGMAGRID on the physical configuration management display. The administrator can also freely modify the combinations of CPU resources and I/O resources on the physical server configuration display. The configuration displays are offered through the GUI so that the possibility of visual control is featured.

The administrator can also use the provisioning display to set up the physical server configurations. The available operation administration items include the start and stop of each server, selection and introduction of OS environments such as Windows and Linux, and the start and stop of virtual servers in linkage with the "VMware technology."

3. Features of the SIGMAGRID

The SIGMAGRID is based on three key technologies; the "Floating I/O" enabling virtualization of hardware configuration; the "Sigma Highways" enabling high-speed data transfer between the system modules; and the "Dynamic Pool" enabling optimum distribution of the hardware resource pools (**Fig. 1**).

(1) Floating I/O

The Floating I/O technology is the basis of "virtualization," which is one of the most impressive features of the SIGMAGRID.

In general purpose server systems, the relationships between

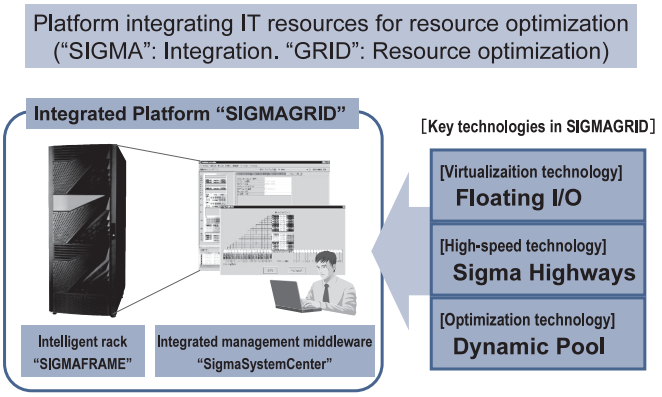

Fig. 1 Three technologies supporting the SIGMAGRID.

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the processors and I/O are fixed and unchangeable. This procedure has tended to cause an imbalance between resources and has often made it necessary to prepare more than the required number of certain resources in order to meet the performance requirements of the services.

On the other hand, the SIGMAGRID is capable of freely modifying the relationships between the CPU resources and I/O resources by inserting a crossbar network between the CPU and I/O.

In addition, the SIGMAGRID can control the relationships between the CPU, I/O and storages flexibly so that it is not required to prepare a dedicated machine for reserve. If a fault occurs with the CPU, a CPU resource can be selected from other resources in order to replace the faulty module. The software environment can also be used without change because the stored content that has been used by the faulty CPU is inherited. This arrangement therefore makes it possible to easily reduce the overall system costs.

For instance, when the web server is extended, the speeds of the I/O resources (disk access speeds) do not need to be so high. As a result, a scale-out type server extension that reduces costs for I/O resources becomes possible by sharing a single I/O resource (or two in the case of dual redundancy) with several CPUs (Express 5800). In case the web server capability becomes insufficient due to a concentration of accesses in a site, the capability can be extended by adding CPU resources to the shared I/O.

On the other hand, a database server extension requires high speed I/O resources. In such a case, the I/O bandwidth is assured by causing the I/O resources to be occupied by individual CPUs.

(2) Sigma Highways

The virtualization of I/O as described above necessitates an increased speed of the data transfer backbone and a mechanism that facilitates module additions. This is implemented by the second key technology called the Sigma Highway technology. The Sigma Highway is the generic naming of a high-speed crossbar network and the mechanism for connecting server modules to it. The SIGMAGRID can include the rack-mount type IA32 servers, which can be installed in the SIGMAFRAME by adding the "special attachments" to the servers. This makes it possible to connect a server to the crossbar network by simply inserting it into a slot and also to implement a flexible configuration using the maximum 10Gbps bandwidth Sigma Highways.

The number of servers that can be inserted into the slots of each Sigma Highway is 16 (with 2-way servers), and the number of I/O modules that can be installed is also 16 (× 2 modules). All of these16 × 16 ways of resource connection pass through the Sigma Highways and there is no need of additional labor such as physical wiring work.

The server module connection mechanism of the Sigma Highway supports the connections to LAN modules and power supply modules as well as those to the crossbar network. The LAN and power supply modules are provided in dual redundancy as well as the connections to them and those between the server modules and crossbar network. Such dual redundancy connections are also provided for the I/O boxes and are available even for the Sigma Highways. This adds to the high accessibility of the SIGMAGRID.

(3) Dynamic Pool

When the virtualization of hardware resources is possible, the next issue is how to utilize the resources more actively. This can be achieved with Dynamic Pool technology, which is the technology for concentrating the virtualized hardware resources in a resource pool and extracting required resources from the pool to implement physical or virtual servers. The physical key to this operation is the "management module." With the SIGMAGRID, the control of the combination of CPU and I/O resources is performed by the management module and the integrated management middleware "SigmaSystemCenter."

4. Examples of Applications of SIGMAGRID

Using the above described technologies, the SIGMAGRID enables construction of the following types of systems.

(1) Compatibility between Server Integration and Client Integration

A system for integrating the clients is possible by integrating job servers in the SIGMAGRID and using the Windows Terminal Service, etc. (**Fig. 2**). In such a system, the SIGMAGRID can be used to optimize daytime and nighttime resource distribution separately. It is for example easy to allocate more resources to the virtual PCs and online job services in the daytime and allocate many resources to the batch job processing servers in the nighttime. This makes it possible to achieve maximum utilization of the limited resources as well as integration of the servers and clients.

(2) Operation of Virtual Servers Using VMware

The SIGMAGRID can use a single "physical server" as multiple "logical (virtual) servers" using the VMware technology. For example, startup of a new job server is possible in two ways using the SIGMAGRID. One way is the method of combining physical resources to start up a single "physical server" and installing the OS and application on it. The other

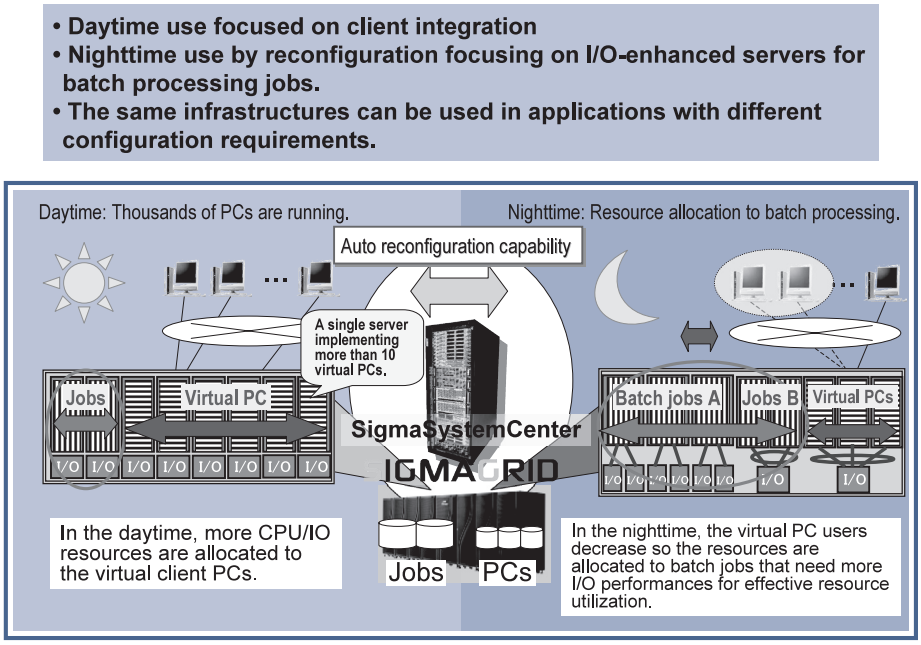

Fig. 2 Compatibility of server integration and client integration provided by SIGMAGRID.

way is the method of adding "virtual servers" to an already configured "physical server." If a physical server with headroom in performance is available, the latter method will make the addition of job servers more easily.

In this way, the SIGMAGRID enables extremely flexible resource utilizations thanks to the Dynamic Pool combining the management module and virtual server technology.

5. Conclusion

In the above, we have introduced the outline of the SIGMAGRID as an integrated platform and explained its key technologies and the functions available by linkage to the SigmaSystemCenter. At NEC, we are planning to enhance this SIGMAGRID further so that it can evolve into a broad area compatible service provision infrastructure that enables implementation of more efficient and flexible systems.

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