

# SPARC Enterprise's Approach to Virtualization and Its Contribution to ICT Society

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In recent years, it has become common practice to implement virtualization technology across servers, storage, and networks. However, simply using virtualization technology is not enough to achieve our intended purposes, which are to optimize systems and reduce costs. The first and most important thing is how to make maximum use of virtualization technology to meet the objectives. As technology advances, it is our responsibility to improve or innovatively change the respective customers' ICT environments by leveraging advanced technology. This paper discusses our strategic approach to the virtualization of the SPARC Enterprise system, Fujitsu's UNIX server, from the point of view of the technologies used. It also describes how our efforts have contributed to the ICT society, introducing some case examples.

## 1. Introduction

There has been a recent increase in the number of servers due to the expanded scale of corporate business and services. In tandem with this, serious issues have appeared such as higher operating costs because of greater power consumption, insufficient installation space and complicated operation management. As a means to address these issues, server integration via virtualization technology<sup>1)</sup> is attracting public attention.

On the other hand, it is difficult to spend enough time constructing an ICT system or to maintain ICT resources for a long period because of constant changes to the business environment such as globalization and M&A. In recent years, public awareness of Cloud computing has been enhanced as an environment to allow companies to use ICT infrastructure as required at the necessary timing. Virtualization technology serves as the basis of this Cloud computing.

Fujitsu's UNIX server SPARC Enterprise<sup>2)</sup>

supports various virtualization technologies. For instance, it supports partitioning technology to enable a system to be reliably split while keeping hardware independence; Logical Domains (LDoms) to operate an independent OS on each virtual server through virtualizing the firmware layer; and Solaris Container to establish a virtual OS on an OS. Optimal virtualization technology can be selected depending on the characteristics of each customer's business process.

Integrating servers via virtualization technology makes investment more effective by reducing hardware- and software-related costs, power consumption and floor space. Besides, having fewer servers because of this integration may lead to lower operation management and maintenance expenses (**Table 1**).

Although virtualization technology brings various advantages as mentioned above, failure to obtain the desired effects or encountering new challenges when actually applying virtualization technology have been reported in some cases as

Table 1  
Effects achieved by introducing virtualization.

Item	Details
ICT cost reduction	Fewer server units and lower license fee
Efficient operation	No need to suspend tasks during maintenance and unified operation
Green ICT	Reduced power consumption and floor space by integration
Prompt service offering	Quicker introduction of new system environment

below:

- 1) Failure to obtain desired effects
  - Significant migration costs arise due to inconsistency of business applications or middleware.
  - Expected performance cannot be obtained because of overhead of virtual environment.
  - Expected cost reduction cannot be obtained due to failure to use virtualized hardware resources in an optimal manner.
- 2) Encountering new challenges
  - Though a system was migrated to a virtual environment, it suffers from degraded reliability because any disturbance of hardware will affect every aspect of the virtual environment.

These examples indicate that just using virtualization technology does not mean a company has reached its goal. Because each virtualization technology has different technical characteristics, it is essential to optimally use technology by effectively using each characteristic to achieve the targeted goal in introducing an ICT.

In this paper, we will introduce the usage of virtualization technology at SPARC Enterprise that inherited SPARC/Solaris architecture. This is based on effective use of each characteristic from the viewpoints of cost reduction by effectively using resources, handing down resources, and improving business process continuity. Further, this paper introduces some examples of adopting virtualization technologies.

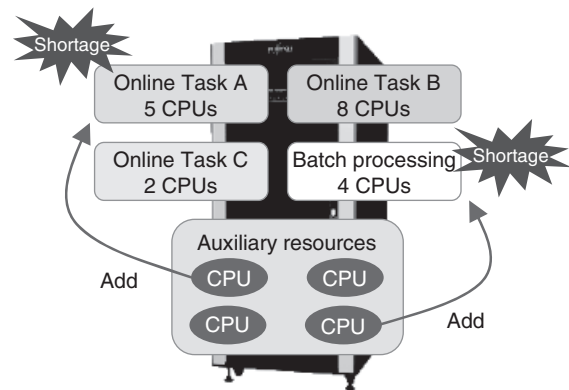


Figure 1  
Effective utilization of CPU resources.

## 2. Effective use of virtualization technologies in SPARC Enterprise

- 1) Reducing cost by effectively using resources
 

Because hardware is independent of software in a virtual environment, it is possible to allocate software to optional hardware resources at the users' discretion. By using this characteristic, it is possible to allocate the hardware resources to any business process as required at any time. Based on this approach, it is possible to eliminate any unnecessary resources.

For instance, if several business processes are virtualized and integrated in a single server, it is possible to pool the unnecessary resources as auxiliary resources. Effective use of resources is achieved by allocating these auxiliary resources to a specific virtual environment only during the hours when there is a high workload (**Figure 1**).

In this case, it is imperative to integrate tasks with different peak time periods to more efficiently reduce resources, because there will not be enough auxiliary resources if peak times for multiple tasks concentrate on the same time period.

- 2) Handing down resources

When migrating to the latest OS or a virtual environment, it is necessary to upgrade middleware and revise and modify applications to

ensure consistency between the new environment and the software resources currently operating on the existing server. Substantial costs are required for the migration, because middleware license fees, and revision and modification fees arise for applications, as do validation costs.

With regard to Solaris 8/9 Containers, it is possible to generate a virtual package of an existing software environment supported by Solaris 8 or Solaris 9. This package is then migrated as it is in the environment of the latest OS, i.e. Solaris 10 Container environment. By using this Solaris 8/9 Container technology, it is possible that the software environment operating on the existing hardware environment is migrated to the latest hardware environment without revising or modifying it (Figure 2).

By preserving customers' inherited resources, they can be migrated to the latest infrastructure environment at a minimal migration cost. This technology has been adopted already by many customers.

### 3) Improving business process continuity

A migration feature is one of the important server virtualization technologies that enables a business process environment to be migrated onto another server while operating the virtual environment. In SPARC Enterprise, this migration feature is supported by LDoms.

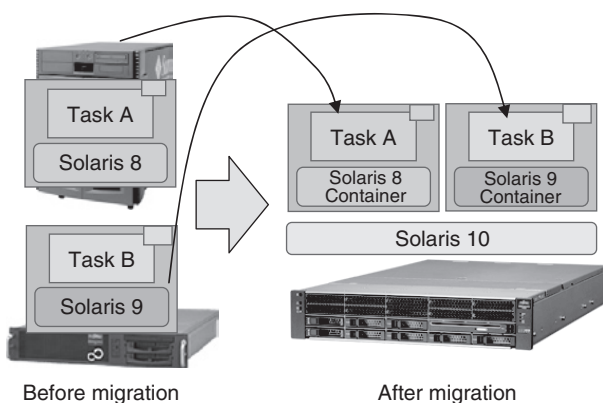


Figure 2  
Solaris 8/9 Containers.

By using this feature, any interruption to a business process due to maintenance can be minimized. In the conventional method, a business process should be suspended and server power should be disconnected during server maintenance. However, dynamically moving the tasks to another server by using the migration feature enables maintenance to be conducted without interrupting the tasks. Besides, it is also possible to achieve a better workload balance across the whole system by moving the virtual environment, where high-load tasks are operating, to a machine with a lower workload by using this migration feature.

## 3. Introduction case

In this chapter, we will report on the case of a customer who actually introduced the virtualization technology. The customer introduced Solaris Container to ensure effective use of resources while ensuring that the existing resources could still be used.

### 3.1 Background to introduction

While the customer introduced a system for each business process for downsizing purposes, there were significant challenges in terms of how to efficiently use server resources. Because each server was designed based on the assumption of a peak time workload, processor availability varied from server to server. On the other hand, it was necessary to add a new server when structuring a new system.

Besides, because the customer uses a report-type application for its business processes, upgrading this application required an enormous amount of work, which made it impossible to completely renovate the infrastructure in a short time.

### 3.2 Key points in introducing virtual system

To address these challenges, multiple work processes operated on application (AP) servers were integrated by Solaris Container.

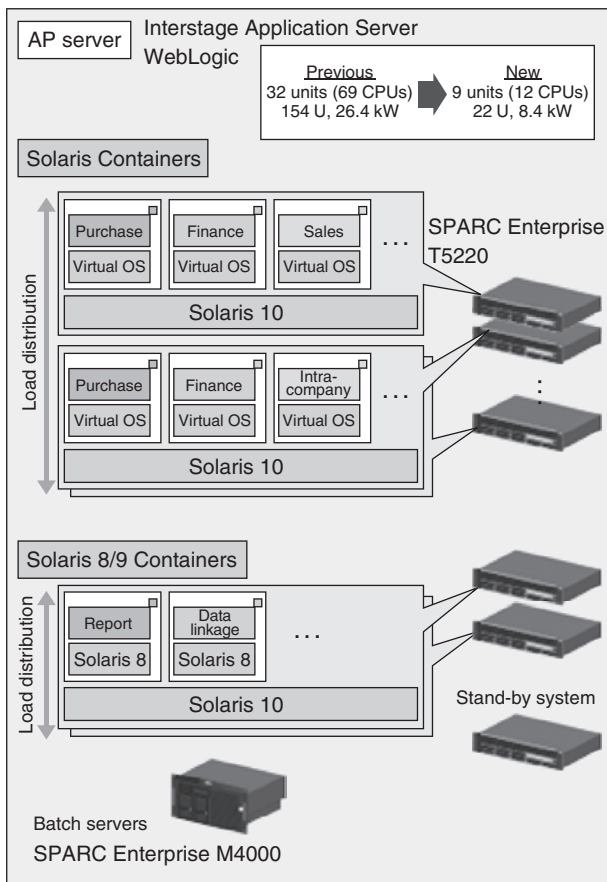


Figure 3 AP server system after migration.

This ensured flexible use of resources such as CPUs and memories depending on the workload fluctuation. SPARC Enterprise T5220 and SPARC Enterprise M4000 were introduced as AP servers. When designing Solaris Container, care was taken to avoid integrating tasks with a similar peak load period in the same machine and also ensure leveling across all machines.

Further, by effectively using Solaris 8/9 Containers, it is possible to operate report-type servers on Solaris 10 without changing applications (Figure 3).

### 3.3 Effect of introduction

By using these Solaris Containers, the amount of resources required could be drastically reduced. For example, the number of AP servers

Table 2 Customer's request and effect of introduction.

	Customer's request	Effect of introduction
1	Want to effectively use resources through server integration	SPARC Enterprise T5220 was introduced as AP server and integration was achieved by effectively using Solaris Container. Effectively using resources meant the number of servers could be drastically reduced to 9 from 32.
2	Want to streamline migration from Solaris 8 to Solaris 10	Resources requiring a long time to migrate are operable on the latest hardware by Solaris 8/9 Containers without changing applications. This secures time to review a future strategy.

could be reduced to 9 from 32, and the number of CPUs could be reduced to 12 from 69 by efficiently using resources. The number of racks was cut by about 50%, resulting in successful cost reductions in operation management such as a reduction in data center fees and reduced power consumption (i.e., CO<sub>2</sub> reduction). If any system upscaling is necessary in future, it will be easy to do by just developing another virtual environment without adding another server.

Further, by effectively using Solaris 8/9 Containers, it will be possible to execute business processes on some new hardware even if it uses software that is hard to upgrade (Table 2).

## 4. Migration to virtual environment optimized for Cloud computing

If conventional business systems are migrated to virtual environments by using virtualization technologies as mentioned above, organizations can address any unexpected increase in or change to tasks without any trouble. This is because no addition or restructuring of hardware is necessary. In addition, it becomes easy to be migrated to the latest platform without revising any business process applications, even if there is a change to the hardware or OS in future.

Furthermore, by using a virtual system file of Solaris ("ZFS"), it is possible to record a

snapshot of the Solaris Container environment at any time. And because it simplifies the process of backing up a virtual environment, operation management of the virtualized task system becomes extremely easy. Further, maintenance of storage is simplified because a company does not need to suspend its business process while adding disk space when it is insufficient.

Thus, a notable improvement in efficiency can be expected in terms of operation management, if the business environment is packaged by combining the above-mentioned virtualization technologies. If Cloud computing is widely used in the future and enormous tasks are operated in data centers, integral management of center operation will be a big issue to be addressed. If an organization system is migrated to a virtual environment, the organization can make a good start in preparing for the age of Cloud computing.



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## 5. Conclusion

This paper introduced the effective usage of Fujitsu's UNIX server SPARC Enterprise based on the effective use of its virtualization characteristics, by referring to an example of a customer. These virtualization technologies are offered as standard features by SPARC Enterprise and their advantages were demonstrated in many customers' environments. Fujitsu is determined to make continued contributions to customers' business by developing the effective use of the latest technologies for SPARC Enterprise and Solaris.

## References

- 1) S. Iyoda et al.: Unified Management Technology for Virtualized Systems. (in Japanese), *FUJITSU*, Vol. 60, No. 3, pp. 234–240 (2009).
- 2) Fujitsu: UNIX Servers SPARC Enterprise. <http://www.fujitsu.com/global/services/computing/server/sparcenterprise/>



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