Efforts Regarding Middleware for Creating Private Clouds

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With the aim of improving the efficiency of corporate business platforms and promptly responding to new businesses while pursuing solutions in cooperation with our customers, Fujitsu will continue to provide new cloud services for emerging business fields. As an introduction to the other papers appearing in this special issue, this paper overviews topics and technologies concerning 1) solutions for continuously strengthening corporate core businesses and 2) our group of three platform middleware products that are central to system integration: Interstage, Symfoware, and Systemwalker. Turning to private clouds, which improve the efficiency of our customers' business platforms, it then describes Fujitsu's efforts regarding these integrated system management technologies from four viewpoints: i) technology and operational know-how acquired through the provision of public clouds, ii) practical implementation of private clouds in in-house development centers, iii) middleware for creating private clouds, and iv) middleware utilization in the cloud. Finally, it describes Fujitsu's efforts from here on towards providing new cloud-computing services targeting new business fields.

1. Introduction

As the Internet continues to spread, the world is, in effect, becoming smaller and smaller, the environment surrounding businesses is changing drastically, and future trends are becoming unclear. In such an era, corporations must have the flexibility needed for efficiently strengthening the operating platforms of their core businesses and the quick-wittedness needed for rapidly responding to new business opportunities. Joining our customers in facing these challenges, Fujitsu is strengthening its product range for supporting solutions and systems integration (SI), introducing products that support our customers' core businesses, and providing new cloud services aimed at emerging business fields (**Figure 1**).

The papers featured in this special issue are presented in the following order. First, topics and technologies related to our three platform middleware products—which form the basis of solutions and SI for continuously strengthening core businesses of corporations—are taken up. After that, Fujitsu's efforts to apply integrated operational technologies to "private clouds" (which optimize customers' business platforms) are described from four viewpoints.

1) Technology and operational know-how acquired from providing public clouds
2) Practical implementation of private clouds in in-house development centers
3) Middleware for creating and using private clouds
4) Middleware utilization "in the cloud"

The portfolio of Fujitsu's middleware products for private clouds is shown in **Figure 2**. Finally, Fujitsu's future efforts regarding new cloud services aimed at emerging business fields are described.

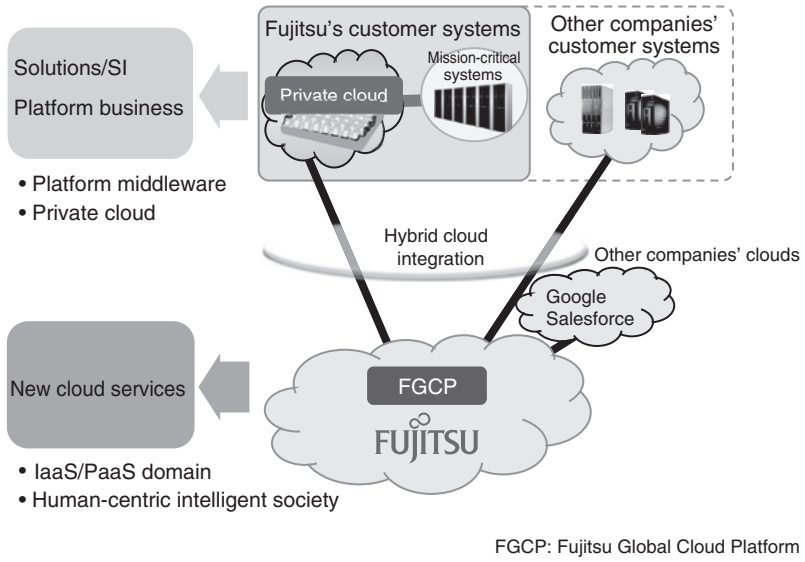


Figure 1
New cloud services from Fujitsu.

2. Platform middleware

2.1 Interstage (middleware for service-oriented architecture [SOA])

Corporate systems based on the Java language have outstanding portability (i.e., ease of transplanting to different environments), and, even in either a public or a private cloud environment, the flexibility and speed of customers' business platforms can be improved by using Java-based systems. Fujitsu is continuing to provide its customers with a common Java-execution environment in the cloud through an "Interstage Application Server," as described by Nagakura et al.[1)]

2.2 Symfoware (information integration)

The Symfoware relational database management system has the unique ability to respond to the continuously expanding scale of corporate systems, as described in the paper by Takata et al.[2)] This technology has been applied, for example, to the in-memory data processing of the Tokyo Stock Exchange's "arrowhead system," which is described in the paper by Hashizume et al.[3)]

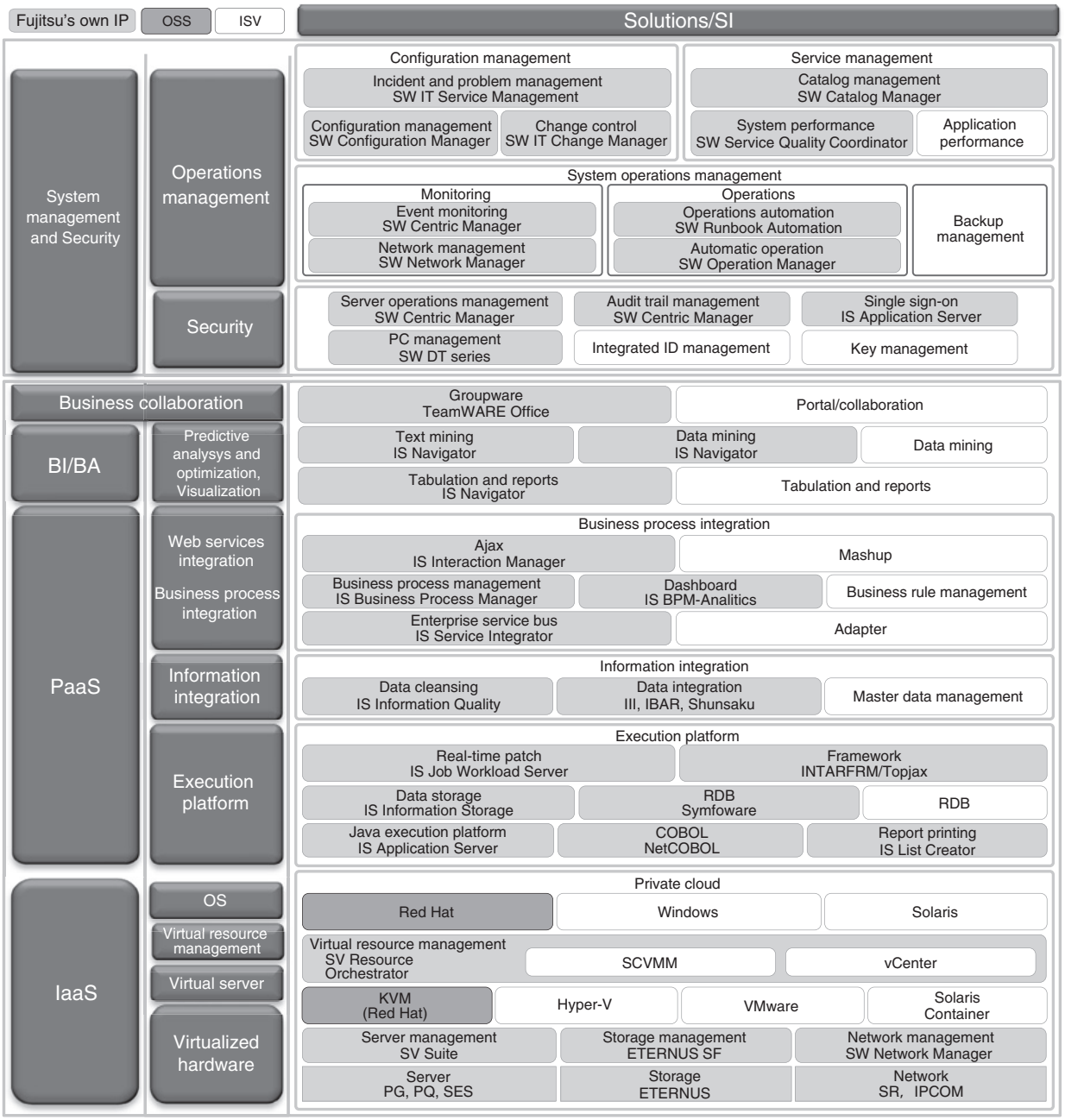
2.3 Systemwalker (ITIL system management)

According to a market survey by IDC Japan in 2009, Systemwalker system management middleware held the top market share in Japan (in the network operations management category). As described in the paper by Shiratori et al.,[4)] products based on Systemwalker are playing a major role in cloud computing as well. They include Systemwalker Centric Manager, Systemwalker Operation Manager, and Systemwalker Service Quality Coordinator.

3. Technology and operational know-how acquired from providing public clouds

Fujitsu has developed a corporate-use "On-Demand Virtual System Service"[note)], which, as described by Yoshida et al.,[5)] is provided as a public cloud, in precedence over products for private clouds. The technology and know-how regarding integration, development, and operation gained from this development is spreading to Fujitsu's products and other

note) Fujitsu has expanded this service under the name "Fujitsu Global Cloud Platform."



IS: Interstage, SW: Systemwalker, SV: ServerView, III: IS Information Integration, PG: PRIMERGY,
IBAR: IS XML Business Activity Recorder, Shunsaku: IS Shunsaku Data Manager, PQ: PRIMEQUEST

Figure 2
Product portfolio for private clouds.

services—starting with middleware for creating private clouds, as described in papers by Matsumoto et al.[6] and by Nakai.[7] Fujitsu Global Cloud Platform was launched domestically as a commercial service in October 2010, and it was extended to five other countries (Australia, Germany, Singapore, the UK, and the US) in June 2011. With these services, Fujitsu is able to provide an environment for seamless operation between public and private clouds on a worldwide scale.

4. Practices concerning private clouds at in-house development centers

To extract the practical know-how necessary for creating private clouds, we are using our in-house development center, the Numazu Software Development Cloud Center. The know-how acquired at this center will be exploited in middleware products for Fujitsu's private clouds and services. This "practical know-how" has become necessary because the corporate needs underpinning private clouds demand that continuity be maintained with current businesses. For example, information and communications technology (ICT) resources and software already used by customers are the starting point from which almost all customers are shifting to private clouds. In general, customers are shifting to private clouds in three stages: virtualization, standardization, and automation. Starting from the current situation in which there is a wide variety of resources (such as servers), we are targeting these stages. The know-how needed is based on requirements closely related to the operations of customers. For example, one requirement is that virtualized tasks are shifted to the cloud without affecting operational services. The know-how needed to ensure that these shifts proceed smoothly comes only from experience in operating customer systems and cannot simply be acquired by newly re-configuring work tasks in a public cloud. The know-how also includes how-to optimize regular operation of the target private cloud systems.

At the Numazu Software Development Cloud Center, 850 different kinds of servers are available for development and testing of Fujitsu's hardware and software product lineup. It is thus a historic representation of customers' resources. Aiming to reduce the costs of operating the center and to strengthen the competitiveness of our products, we have been shifting the activities of the center "to the cloud" since 2008 in accordance with the three stages mentioned above (virtualization, standardization, and automation). The scale of the virtual environment reached 3000 virtual machines (VMs) in 2010. The construction of this development environment is being automated using four of Fujitsu's middleware products:

- ServerView Resource Orchestrator
- Systemwalker Service Catalog Manager
- Systemwalker Software Configuration Manager
- Systemwalker Runbook Automation.

The cloud conversion of the software-development environment at Fujitsu's Numazu Software Development Cloud Center is described in detail in the paper by Arimura et al.[8]

5. Middleware for creating private clouds

In June 2010, Fujitsu started shipping a lineup of middleware products for building and operating private clouds. This special issue introduces the middleware products of Fujitsu.

1) It starts with a paper by Nagakura et al.[1] describing the three stages of cloud conversion using Fujitsu's three main middleware products.
2) ServerView Resource Orchestrator (ROR), middleware for supervising virtualization and resource allocation, and Cloud Infrastructure Management Software (CIMS), a "solution product" that makes it possible to evaluate and utilize private clouds at the customer's site, are then explained by Matsumoto et al.[6] CIMS incorporates a function for configuring a self-portal site based on the ROR and a function for visualizing resource management on a "dashboard." Virtualization technologies serve as the foundation for the visualization and effective utilization of the ICT resources allocated by the ROR. These server-virtualization technologies, Hyper-V, VMware, and Linux KVM, are described by Haga et al.,[9] M. Nishikiori,[10] and Goto,[11] respectively.

3) Murata et al.[12] describe the middleware used for resource provisioning after the systems now used in corporations have been organized into a manageable number of patterns (i.e., standardization and type determination). The Systemwalker Software Configuration Manager is used to reduce the load of operators imposed by provisioning.
4) The middleware for automating operations, Systemwalker Runbook Automation, is described in a paper by Ito.[13] This middleware optimizes the operation of the ICT infrastructure, which has traditionally been done manually. It facilitates standardization and automation by creating work flows. Ito[13] describes the present state of and future activities regarding this middleware.
5) The Systemwalker Service Catalog Manager is described by Nakai.[7] It manages virtualized and standardized systems; that is, each (sometimes complicated) system is provided for users as one combined set of resources through a notion of service, which reduces the operational load created by the loaning and returning of virtualized systems.
6) A function that enables CIMS to "visualize" resources in a private cloud is described in a paper by Shiratori et al.[4]
7) Utilization of private clouds and public clouds in a combined manner—which is made possible by the middleware products listed below—is described by Funabashi et al.[14]

- Interstage Interaction Manager
- Interstage Information Integrator
- Interstage Business Process Manager

6. Utilization of middleware in the cloud

Two areas being addressed with the aim of making Fujitsu's middleware available "in the cloud" are introduced. Our efforts related to Fujitsu Global Cloud Platform to support operations for creating virtual systems are described in a paper by Hatakeyama et al.[15] One area is optimizing installation procedures for middleware. The other is providing system management features of ICT systems as software as a service (SaaS), as described by Iwasa.[16]

7. Future activities

Finally, under a backdrop of spreading utilization of cloud computing, efforts regarding Fujitsu's cloud-computing services in the future are described here.

At Fujitsu, by utilizing cloud computing (which makes use of abundant ICT resources) to link and analyze data of conventional-form business applications and data of human-centric real-world-form applications (i.e., applications using data from mobile phones, various kinds of sensors, and so on), we are aiming to create an "intelligent society"—that is, a society that will bring new value and knowledge to the public at large as well as to businesses.

The solutions we will provide in the intelligent society will be obtained in an "assumption-verification form" (i.e., solutions are sought while present circumstances are visualized and assumptions are made in parallel) as opposed to the conventional "problem-solution form" (i.e., problems are defined and formulated beforehand in the manner of conventional corporate systems). Moreover, with these solutions, unlike the case of conventional industry-classified business systems, we are required to utilize data across various businesses and fields.

At present, to meet this requirement, while providing services that can connect and analyze various types of data from numerous fields, we are pushing ahead with research and development aimed at providing middleware for creating cloud services that will enable our customers to detect and respond to new challenges while continuing

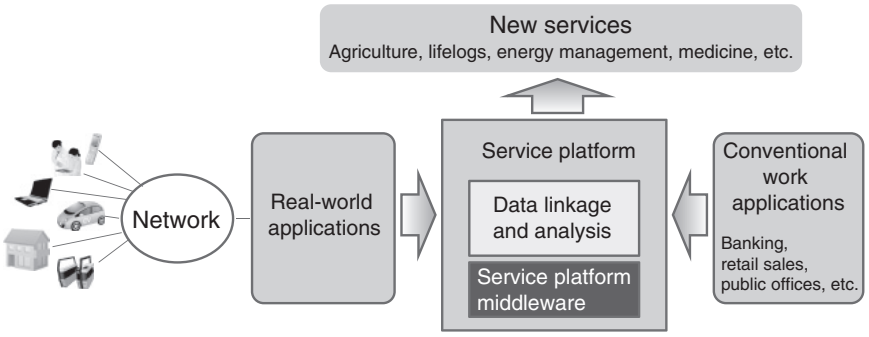


Figure 3
Approach to service-platform middleware.

to evolve (**Figure 3**).

8. Conclusion

Having built, operated, and maintained the corporate systems of many of our customers, Fujitsu believes it can respond to the demanding cloud requirements, even those of major, long-established corporations, by means of the efforts and technologies described in this special issue. We believe that the outstanding features of Fujitsu's products and technologies for cloud computing will become evident from reading the papers herein describing our efforts concerning private and public clouds.

References

1) H. Nagakura et al.: Middleware for Creating Private Clouds. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 263–269 (2011).
2) K. Takata et al.: Symfoware Server—Reliable and Scalable Data Management. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 277–284 (2011).
3) Y. Hashizume et al.: Ultra-high-speed In-memory Data Management Software for High-speed Response and High Throughput. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 316–324 (2011).
4) T. Shiratori et al.: Operations Visualization for Private Clouds. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 311–315 (2011).
5) H. Yoshida et al.: Service Oriented Platform. *Fujitsu Sci. Tech. J.*, Vol. 46, No. 3, pp. 410–419 (2010).
6) H. Matsumoto et al.: Dynamic Resource Management in Cloud Environment. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 270–276 (2011).
7) T. Nakai: Private Cloud Using Service Catalog. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 305–310 (2011).
8) Y. Arimura et al.: Cloud Computing for Software Development Environment—In-house Deployment at Numazu Software Development Cloud Center—. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 325–334 (2011).
9) Y. Haga et al.: Windows Server 2008 R2 Hyper-V Server Virtualization. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 349–355 (2011).
10) M. Nishikiori: Server Virtualization with VMware vSphere 4. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 356–361 (2011).
11) Y. Goto: Kernel-based Virtual Machine Technology. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 362–368 (2011).
12) K. Murata et al.: Provisioning of Standardized Business Systems. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 293–299 (2011).
13) H. Ito: Operation Efficiency Improvements for IT Infrastructure through Runbook Automation Technology. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 300–304 (2011).
14) M. Funabashi et al.: Fujitsu's Approach to Hybrid Cloud Systems. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 285–292 (2011).
15) T. Hatakeyama et al.: On-demand Middleware Delivery Services for Cloud Computing. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 342–348 (2011).
16) K. Iwasa: IT Management SaaS. *Fujitsu Sci. Tech. J.*, Vol. 47, No. 3, pp. 335–341 (2011).

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