Private Cloud Platform Based on Open Source Technology

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In recent years, due to rapid technological advancements such as big data utilization, cloud computing, mobile communications/devices, and social media, business owners have been urged to transform their information and communications technology (ICT) systems. However, many companies hesitate to embrace the ICT innovation because they have been incurring a lot of cost with the systems virtualization and integration they have carried out so far. To resolve this situation, Fujitsu proposes FUJITSU Integrated System PRIMEFLEX for Cloud K5 (hereafter, PFC-K5), an integrated private cloud solution. This solution is also one of the private cloud solutions of FUJITSU Digital Business Platform MetaArc. PFC-K5 provides an optimal combination of hardware and software for business operations on the cloud, and this solution is delivered to the business owners in a ready-to-use condition. PFC-K5 not only supports business operation lifecycle by providing optimal ICT systems, but also enables business owners to introduce the latest cloud technology to their ICT systems at low cost. Moreover, through infrastructure standardization and automation, business owners can use this solution to reduce their operational cost, and hence move forward with transforming their ICT system. This solution is based on the same technology as FUJITSU Cloud Service K5, making it possible to build a hybrid cloud environment. This paper describes an overview and the features of PFC-K5.

1. Introduction

The information and communications technology (ICT) environment surrounding companies is now rapidly changing, as exemplified by big data utilization, cloud computing, mobile devices, and social media. General consumers are expecting quicker availability of new applications and services more than ever. With these changes in the background, companies are urged to shift from reducing the costs and improving the operational efficiency of conventional systems (SoR)[note 1)] to having systems that create new values (SoE).[note 2)]

To create new values, what is important is to come up with ideas before others and make use of the feedback on them to develop products and services. ICT systems are required to execute this process speedily. Accordingly, companies that have integrated and aggregated servers up to now are asked to make further changes. However, many companies find it difficult to take a step toward transforming their ICT systems and shifting to SoE because they have incurred a lot of cost with the maintenance and operation of their large-scale and complicated SoR. To deal with this issue, Fujitsu proposes FUJITSU Cloud Service K5 (hereafter, K5 Service),[1)] a public cloud service capable of flexible linking between SoR and SoE.

This paper presents FUJITSU Integrated System PRIMEFLEX for Cloud K5 (hereafter, PFC-K5), a private cloud platform that employs the same technology as K5 Service.

note 1) Abbreviation for Systems of Record. The term refers to conventional business processing and record systems.

note 2) Abbreviation for Systems of Engagement. The term refers to systems that create changes by connecting between people and things.

2. Issues with operation and measures for private cloud

A private cloud makes it possible to quickly deploy the required resources on demand. A private cloud

Table 1
Common issues with virtualization and their measures.

Issues	Goals	Measures
Each organization has its own operation rules	Standardized operation rule within a company	Establish control over ICT infrastructure operation and guideline •System operation standards •Security standards
Each organization has different guidelines for business continuity planning	Each organization coordinates its guidelines with BCP,★ the company's policy	
Different ICT architecture among organizations which causes know-how to differ	Standardized ICT architecture	Establish a standardized system infrastructure
Some organizations may have unused resource while others are facing resource insufficiency	Efficient ICT resource usage	Establish a shared ICT infrastructure
Infra-administrator is burdened with the frequent demand for resource planning	Dynamic resource allocation	
Resource capacity frequently changes as workload changes	Automatic resource scaling	Automatize resource provisioning and scaling
Risk of human error	Process automation	
Shortage of operators	Self-service operation	Provide a self-service portal

★: Stands for business continuity plan. A set of measures established by a company from the perspective of business continuity on the assumption of contingencies such as disasters.

realizes optimal physical space utilization and system resources by virtualizing and aggregating the physical hardware. Virtualization technology is used as a fundamental technology for private clouds that allow rapid resource provisioning for application development. Additionally, virtualization reduces the total cost of ownership (TCO) by reducing the amount of servers required. However, in reality, virtualization actually incurs a lot of cost to operate and maintain, which means many companies are unable to invest in new fields.

After introducing virtualization to their ICT systems, many companies are faced with operational issues as follows.

1) Siloed infrastructure
- The ICT infrastructure varies for each department and the operation is inefficient.
- The standard of security and disaster control varies for each department and the quality of risk measures of the entire system decreases.
- Know-how is not shared and kept within an individual organization, which makes it very difficult to standardize operation, resulting in inefficiency.
- To ensure resource sufficiency, system resources are estimated and allocated based on peak workload capacity, resulting in inefficiency.

2) Limitations of manual operation
- As the number of virtual servers increases in a short period, ICT resources and capacity planning[note 3)] become more frequent, and therefore manual planning is ineffective.
- The task of adjusting the amount of system resources has increased and caused a greater burden on the system administrator.
- Configuration of servers, networks, storage, etc. has become complicated and is causing an increased risk of human errors in manual operation.
- The number of operators is insufficient for dealing with the increase in virtual servers.

Resolving these issues requires the combination of infrastructure control, standardization, automation, and self-service system provisioning. Measures for resolving the issues with operations are shown in **Table 1** and explained below.

- Establish control over ICT infrastructure operation and guideline

Under the present conditions, many companies face siloed[note 4)] infrastructure issues. The ICT infrastructure is operated individually within an organization. While system optimization is attempted, there is no collaboration among organizations. In order to resolve this situation, it is necessary to establish ICT infrastructure operation standards and security standards in the

note 3) Refers to planning the amount of resources (such as servers, networks, and storage) required for a system.

note 4) Refers to a condition in which no information sharing or linkage is in place between departments in a company and the systems of the individual departments are isolated.

entire organization. A private cloud can introduce system standardization with an integrated solution.[note 5)] An integrated solution allows companies to standardize the infrastructure of their ICT systems.

- Establish a standardized system infrastructure

To avoid depending on the know-how of individuals in an organization, standardization and automation of system provisioning by using service templates are necessary. A service template standardizes the deployed systems by defining specific configurations of the system. Meanwhile, service automation orchestrates business systems (system deployment, change, deletion, etc.) by using a self-service portal.

- Establish a shared ICT infrastructure

Individual resource planning not only leads to inefficient use of system resources but also a difficulty in extending the system resources. This may result in an increased burden on the infrastructure administrator. To improve the efficiency of system resource utilization, it is necessary to enable physical servers, networks, and storage to be shared within a company. In addition, a system is required in which system resources are registered in a resource pool[note 6)] and deployed when requested. Planning system resources based on past usage can improve the efficiency and reduce the workload of the infra-administrator.

- Automatize resource provisioning and provide a self-service portal

As virtualization and private clouds become increasingly common, configuration of ICT infrastructure is growing more complicated. For this reason, depending on manual labor gives rise to the possibility of operational errors. Accordingly, it is necessary to reduce manual labor by automating the operation or making it self-served. For example, this can be done by automatizing system deployment using a self-service portal. To cope with an unexpected shortage of system resources, automatic system scaling is necessary.

The measures explained above are realized by PFC-K5, which will be explained later.

note 5) A system that integrates hardware and software and is verified in advance before delivery to customers.

note 6) A function of providing computing resources such as physical servers, networks, and storage according to the request.

3. Fujitsu's approach

In 2012, Fujitsu announced FUJITSU Integrated System Cloud Ready Blocks (hereafter, CRB),[2)] an integrated virtualization and cloud platform product. CRB incorporates servers, storage, networks, and software required for virtualization. Moreover, server installation and testing will be performed at FUJITSU in advance before delivering it to the customer. Using this solution, the customers do not need to build and configure their private cloud infrastructure and hence the customers can introduce a private cloud immediately at low cost. As the virtualization and cloud platform management software, CRB introduces FUJITSU ServerView Resource Orchestrator (hereafter, ROR).[3)] ROR provides functions essential for private cloud operation such as a self-service portal, standardization, and automation using the ROR template. ROR is also used as the platform of Fujitsu's public cloud service FUJITSU Cloud Service S5.[4)]

In 2015, Fujitsu renewed its integrated product lineup and announced FUJITSU Integrated System PRIMEFLEX.[5)] As a virtualization and cloud platform, FUJITSU Integrated System PRIMEFLEX for Cloud (hereafter, PRIMEFLEX for Cloud) has been released. PFC-K5 presented in this paper is a model of PRIMEFLEX for Cloud.

4. PFC-K5

PFC-K5 is a private cloud integrated product which is based on the same open-source technology and architecture as K5 Service. K5 Service is the core service of FUJITSU Digital Business Platform MetaArc (hereafter, MetaArc).[6)] **Figure 1** shows how PFC-K5 is positioned in MetaArc and **Figure 2** its configuration. The know-how acquired in K5 Service is also utilized in PFC-K5 to improve and optimize private cloud operation. This increased the efficiency of our customers' ICT usage and helped them to transform their ICT systems.

PFC-K5 can be classified in the following three levels of optimization.

1) ICT optimization at intra-departmental level

System resources are shared by using resource pools.

2) Optimization of the entire organization

Operation know-how is standardized, and system provisioning is automated and self-serviced.

3) Cross-corporate and industrial optimization including partners and customers

Accelerate modernized ecosystem formation.

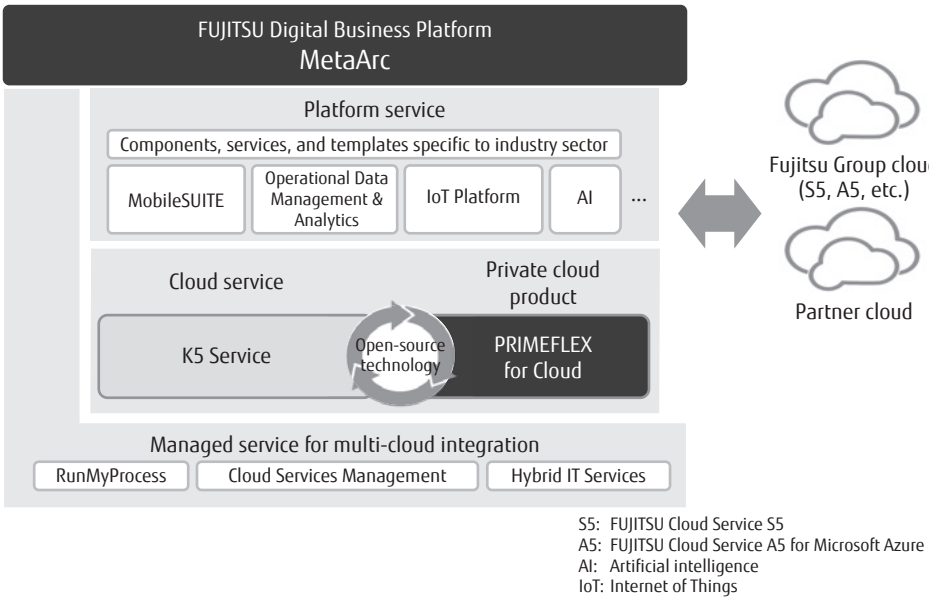

Figure 1
Positioning of PFC-K5.

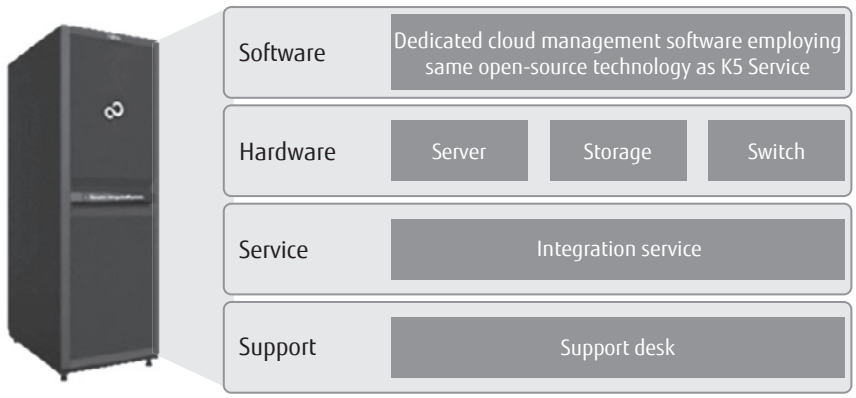

Figure 2
PFC-K5 configuration.

5. Product features

PFC-K5 features the following as a private cloud platform.

- Based on the same technology as Fujitsu's public cloud K5 Service

K5 Service features the capability of realizing new business development by seamlessly linking between SoR and SoE. Repeating the cycle of transforming the data accumulated by SoR to a new value by SoE makes it possible to create new business value. K5 Service adopts OpenStack,[7] as its cloud platform so it can continually introduce the newest cloud technology to the customer. On the other hand, PFC-K5 provides the following benefits by employing the same technology as K5 Service.

1) Effective resource utilization in hybrid cloud environment

PFC-K5 provides a high-portability hybrid cloud environment (**Figure 3**). For example, if a resource shortage occurs in a private cloud, virtual machines and data can be migrated to a public cloud temporarily. This allows system resources to be effectively used.

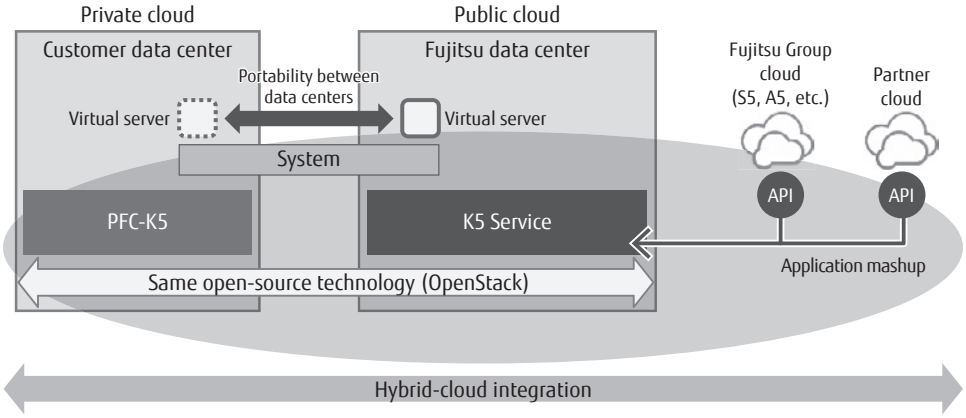

Figure 3
Realization of hybrid cloud with same open-source technology.

2) Standardized operation

PFC-K5 adopts OpenStack, the same technology as K5 Service. This allows users to directly access and operate the system resources using OpenStack application programming interfaces (APIs). The compatibility with open standard interfaces makes it possible to avoid being dependent on a specific vendor.

3) Easy operation and high functionality and reliability

The self-service portal and service template are provided. In addition, a multi-tier system template which includes a firewall and load-balancer also can be created for deploying business systems with security and reliability ensured.

- Verified and tested hardware and software

PFC-K5 is delivered to the customer after it has been verified and tested. This eliminates the need for verification by the customer. In addition, optimum resource capacity also will be verified and tested. Hence, this improves the efficiency of capacity planning.

- Ensure stable operation with auto-scaling

Auto-scaling is the capability of a cloud platform to automatically increase or decrease virtual servers or computing resources (such as CPU, memory, or disk) according to the system workload. In PFC-K5, the auto-scaling is enabled in the orchestration template. Therefore, sizing and resource reservation according to the system peak are unnecessary and system resources can be efficiently used.

- Realize safe and secure business systems

It is possible to have advanced access control by using security groups and the firewall service.

PFC-K5 is capable of resolving the issues with operation of a private cloud thanks to the product features mentioned above.

In the future, as an approach to accelerating the transformation of ICT systems to SoE, PFC-K5 will provide Platform as a Service (PaaS) functionalities as well.

6. Conclusion

This paper has described FUJITSU Integrated System PRIMEFLEX for Cloud K5, an integrated private cloud platform product that adopts the OpenStack technology. By using an open-source technology, technological evolution can be promptly reflected in the systems to constantly provide customers with cutting-edge technology. This product is based on the same technology as Fujitsu's public cloud FUJITSU Cloud Service K5. It realizes system migration between public and private clouds.

FUJITSU Integrated System PRIMEFLEX for Cloud K5 can reduce TCO by resolving various issues with private cloud operation to accelerate the transformation of ICT systems. Furthermore, it supports ICT innovation as an infrastructure platform.

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