Technology to Automate System Operations for Flexibly Responding to Dynamically Changing Cloud Environments

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Cloud services (hereafter referred to as "the cloud") and virtualization technologies are rapidly growing in popularity. There is increasing demand for corporate information systems to be efficient, optimized ones which do not consist solely of on-premises systems, but also employ private and public clouds where appropriate. Virtual environments and private clouds are often composed of large numbers of physical servers and devices in order to enable them to accept all the execution environments of widely distributed operational systems. This shift of corporate information systems to large-scale environments composed of diverse server devices has made it difficult to manage these environments manually. This problem has been addressed by automating system operation work, which involves creating scripts that perform sequences of commands, reducing management workload. However, simple automation scripts have difficulty handling operations which span multiple servers. This has required operation procedure documentation to be created and much work based on the documentation to be performed. This paper introduces Fujitsu's development and operation of FUJITSU Software Systemwalker Runbook Automation, which dramatically improves operation efficiency by standardizing, creating workflows, and automating the operation of corporate information systems, which has until now been done manually.

1. Introduction

With the increased use of cloud services (hereafter referred to as "the cloud") and virtualization technologies, corporate information systems have grown more complex. At the same time, there is strong demand for information and communications technology (ICT) companies to of course promote the creation of corporate information systems which provide stable services and the flexibility to rapidly respond to changes, at low cost and with little operation overhead, in order to offer 24/7 business continuity and respond to sudden changes in the business environment.

This paper introduces, as a way to handle the above issues, Fujitsu's development and operation of FUJITSU Software Systemwalker Runbook Automation[1)] (hereafter referred to as "RBA"), which dramatically improves operation efficiency by standardizing, creating workflows, and automating the operation of corporate information systems, which has until now been done manually.

2. Challenges involved in increasing system operation efficiency of cloud environment

There is increasing demand for corporate information systems to be optimized by combining private and public clouds appropriately, as well as on-premises systems installed and used within companies.

This has increased the management scope of system administrators, while producing changes in the methods used to manage systems, increasing the workload involved in system operation management and creating new challenges when attempting to reduce operation costs.

Usually, virtual environments and private clouds, which accept clouds that accept all the execution environments of widely distributed operational systems, are often composed of large numbers of physical servers and devices. This shift to large-scale system environments composed of diverse server devices has made it difficult to manage these environments manually. For

example, differences in models and operatingsystems (OSs) in system environments make management operations more complex. System administrators must perform maintenance using the procedures which correspond to the individual physical servers, operating systems, and interfaces on which the work will be performed. This requires a great deal of effort in terms of learning about individual operating systems and the differences between various work procedures. Furthermore, private cloud usage includes operations such as the lending and returning of virtual servers, and the corresponding additional workload of approving these operations. The involvement of human operators in these processes results in a difficulty in operating.

These problems have been addressed by automating system operation work, which involves creating scripts to perform sequences of commands, thus reducing management workload. However, simple automation scripts have difficulty handling operations which span multiple servers, operations which differ by OS or middleware version, operations requiring human input (determining what devices to perform operations on and confirming results), and the like. This has required operation procedure documentation to be created and much work based on the documentation to be performed. This approach is not a sufficient solution to these challenges.

In cloud environments, virtual servers are frequently added and deleted. Revising procedures to reflect changes in the affected servers also places a burden on administrators (**Figure 1**).

In this way, a complex cloud environment is heavily dependent on manual operations. A key point in achieving greater operation efficiency, then, is the automation of manual operations done by workers.

3. Market trends in increasing system operation efficiency of cloud environment

There is a growing need for system operation, which has been performed manually in the past, to be standardized and organized in workflows in order to automate the entire operation management process, dramatically improving efficiency. This automation provides a wide range of benefits, such as reducing the operation workload caused by simple tasks, preventing human error, improving service levels, ensuring compliance, and reducing operation costs.

According to IDC Japan, the operation automation market is expanding, growing by 41.6% year-on-year in 2012 and 38.7% in 2013.[2)] This growth has been led primarily by the automation of virtual server management, such as virtual server addition and deletion, but in recent years there has been tremendous growth in the automation of the entire operation management process. The number of major companies streamlining operation processes when shifting to virtual and cloud environments is rising.

The arrival of virtualization and private clouds has stimulated new demand in the operation automation market. Vendors, both in Japan and abroad, have responded by focusing their efforts on launching new products.

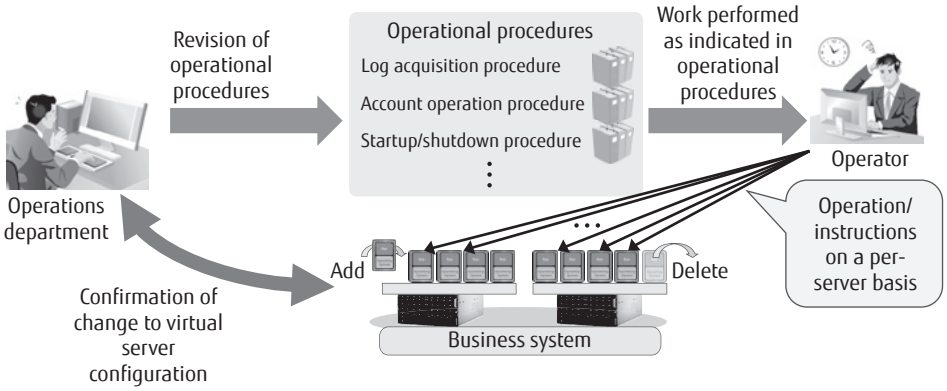

Figure 1
Revising operational procedures in conventional systems.

4. Fujitsu's approach to increasing cloud operation efficiency

Ever since the 2010 release of RBA, Fujitsu has helped support the automation and improved efficiency of overall operation management processes by registering operations in the system, which were previously performed manually, as "automated operation processes (operations flows)."[3)]

By interlocking with CMDB (configuration management database), which centrally manages the auto-detection of the relationship between the components of the system, RBA can efficiently automate the operational work of the complex cloud environment. Specifically, information about on-premises physical servers, private cloud virtual servers, and public cloud virtual servers is automatically collected by CMDB agent function. This collected server, OS, and other information is used to make dynamic changes to automatic operation processes. This makes it possible for operation administrators to accurately understand and manage current system configurations without needing to consider server additions or removals (**Figure 2**).

Functions which integrate CMDB information and operations are provided by other companies as well. However, a major strength of Fujitsu's approach is that it makes it possible to achieve advanced operation efficiency improvements, such as by integrating CMDBs with Systemwalker series products and the FUJITSU Software ServerView Suite[4)] system integration and management tool to change server monitoring settings based on virtual server deployment.

This middleware also offers the following features.

1) Centralized management and control of the overall operation process, including work which involves human operation

RBA makes it possible to centrally manage entire operation processes, including not only OS and middleware operations, but also confirmation and determination work performed by operators. The creation of virtualized infrastructures produces multiple roles, such as system management and business operation management. RBA controls the entire operation process, including application and approval work, ensuring that operations are performed in accordance with defined application and approval routes, and reducing data center operation workload (**Figure 3**).

2) Flexible interruption and resumption of automated operation processes

RBA offers the operation flexibility to interrupt running operation processes when urgent work needs to be performed, and to resume the interrupted operation processes once the urgent work has been completed.

3) Reliable implementation of regular operation work

Not only does RBA automate operation processes, but it can also automatically start up regular operation work based on monthly operation schedules. It can also flexibly handle urgent operation changes by changing startup schedules or suspending startup processes. It offers both the reliability of operations that is achieved by using a schedule with the flexibility to handle customer operation requirements (**Figure 4**).

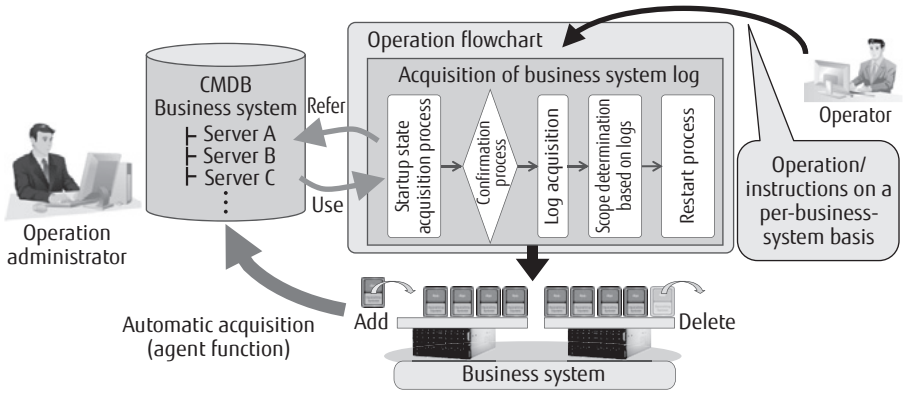

Figure 2
Efficient management using CMDB.

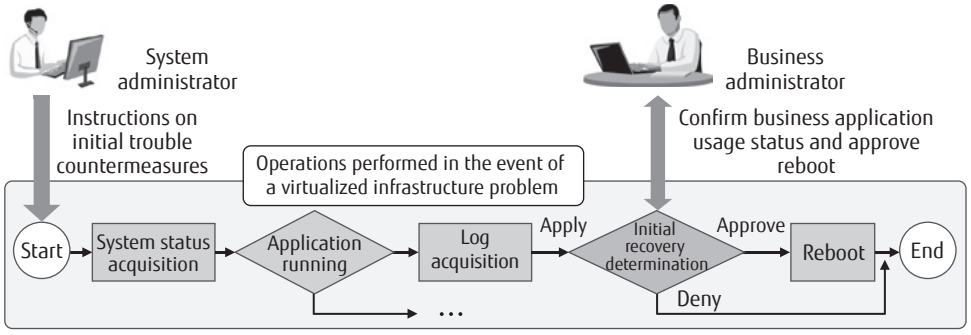

Figure 3
Automation of work performed in response to system problems.

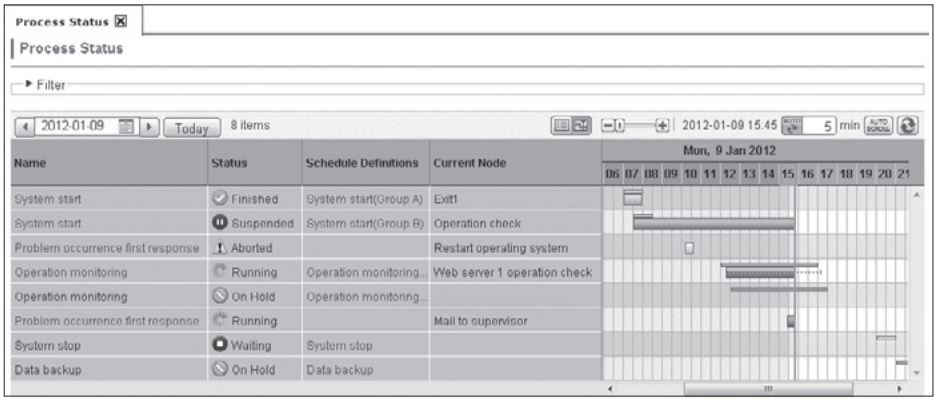

Figure 4
Automatic startup of regular operations.

4) Operation control components for easy creation of automated operation processes

RBA can standardize operation work, by smoothing over the functional variations among differing platforms, software, and devices.

Operations which are needed for operation work (server shutdown orders, standby, shutdown confirmation, etc.) are offered in the form of operation control components. Generally speaking, operations and commands differ by OS and middleware. Operation control components can be used to automatically determine which commands and options are used by individual servers, operating systems, and middleware. This makes it possible to perform operation management work without having to take into consideration multi-platform environments. Furthermore, it is not necessary to know about the difference between servers and physical/virtual servers, and there is no need for advanced knowledge regarding specific operating systems or middleware. This makes it possible for operation work to be performed without relying on the skills of individual operators.

RBA performs batch operation of multiple servers, operating systems, and middleware, so group processing components and control components for performing repeated processing are also provided. These can be used to easily work with a wide range of objects.

5) Simple, safe automation using operation practice-based templates

Data center operations require accurate knowledge and operation not only of servers, but also of system infrastructure elements such as virtualization software, and of business systems. RBA provides templates for automating various operations, created based on processes which have been tried and tested in data center operations. These templates can be used to perform operations in the correct order, such as

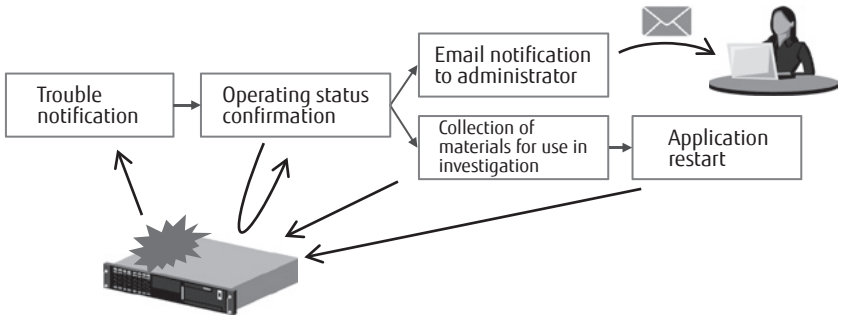

Figure 5
Template-based problem response.

starting up and shutting down three-tier web systems, or responding to problems by performing initial problem isolation, issuing alerts, and implementing initial countermeasures (**Figure 5**). They can also reduce operation costs and prevent operation process errors.

6) GUI-based development and debugging

Automated operation processes can be created easily just by dragging and dropping operation control components categorized by individual operation. These automated operation processes can be debugged by using the graphical user interface (GUI) to check the process flow and changes in variables, making it possible to confirm that created operation automation processes will function correctly.

This makes it possible to easily convert operation procedures into automated operation processes.

5. Conclusion

The FUJITSU Software Systemwalker Runbook Automation (RBA) introduced in this paper automates operations previously performed manually, helping improve the operation of corporate information systems. As an example of an actual result, one company that introduced RBA to automate its work operations was able to reduce the working time required for the operation of about 70 systems by a total of 1000 hours a month.

As cloud usage grows, Fujitsu will continue to develop products which contribute to improving the efficiency of customer system operation, even in mixed environments combining private clouds, public clouds, hybrid clouds, and on-premises systems.

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