Operations Visualization for Private Clouds

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For the operation of private clouds to be made more efficient, the ICT resources (servers, storage devices, networks, etc.), which are becoming huge in number, must be managed more efficiently. This means that a company's infrastructure management department must perform a comprehensive survey of the state and usage conditions of ICT resources, assess problems quickly, and take appropriate action. A comprehensive survey can be achieved by visualizing the operation of the private cloud. Fujitsu's Systemwalker Service Catalog Manager V14.1 and Cloud Infrastructure Management Software V1.2 provide two means of visualizing resources and the resource pool. These virtualization capabilities enable an administrator to perform an integrated check on two things; the existence of performance problems and the available capacity of resources. This makes operations management of private clouds more efficient. This paper describes the role of virtualization in making private cloud operations more efficient and introduces the operations visualization provided by these products.

1. Introduction

One of the purposes of introducing private clouds is to integrate and use ICT resources effectively by using visualization technology. To achieve this purpose, any surplus resources should be minimized. On the other hand, if the amount of surplus resources is lower than the necessary level, task processing may be disturbed due to insufficient processing capacity when the workload is high. Administrators who operate private clouds need to satisfy both of these contradicting requirements (effective use of resources and stable operation of tasks) at the same time. This is even more difficult as they are in complex environments where physical resources and virtual resources exist side by side. To achieve this objective, it is imperative to determine what information is necessary for effective and stable operations in an integrated manner and on a real-time basis, and to quickly detect any problems and find solutions. This is what we call operations visualization.

In this paper, we will describe operations visualization as a priority issue in the operation of private clouds, focusing on the necessity of operations visualization and the needs of infrastructure managers. Then, we will introduce our Systemwalker Service Catalog Manager V14.1 (hereafter CT-MG)[1] and Cloud Infrastructure Management Software V1.2 (hereafter CIMS)[2], which are operations visualization software that we launched in January 2011. To conclude the report, we will state the issues we need to address in the future.

2. Why operations visualization?

To effectively operate systems on private clouds, an infrastructure manager has to handle an enormous amount of ICT resources and their complicated mutual relationships.

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Because the ICT resources that belong to each department are integrated, the amount of ICT resources managed by an infrastructure management department may be enormous. For instance, in Fujitsu's Numazu Software Development Cloud Center, the number of physical servers was reduced to approximately 1000 from 1800 by introducing a cloud system in the software development environment (FY2010). With this reduction, an environment for virtual servers was constructed to optimize the development environment. The number of virtual machines (VMs) increased from 900 in 2008 to 2300 in 2010. This was a case of cloud introduction at Fujitsu, but some clients want to make a small start, first setting up 50 to 60 VMs and gradually expanding their system scale to between 500 and 1000 VMs. This means their infrastructure management departments will need to manage around 1000 VMs in the future.

Virtualization is another reason why operations management is becoming more complex. With conventional systems, one business application is arranged on one physical server, and the ratio of physical servers to business applications is 1:1. Through virtualizing systems, this relationship changes to 1:N. For instance, if one physical server supports five VMs, and if one business application is arranged on each of these VMs, the relationship is 1:5. If any one of these business applications fails and its I/O load is increased, the other four business applications supported by the same physical server may be impacted, and this may lead to degraded I/O performance. Nevertheless, it is hard for those operating the business to guess the real cause of any performance degradation, because these business applications and VMs operate normally themselves. It is difficult to promptly detect the cause of any disturbance and find a solution unless the infrastructure management department precisely understands the relationship between its VMs and physical servers. To be specific, the management department should know which VM is supported by which physical server and which other VMs are supported by the same physical server.

To overcome this difficulty, a company's infrastructure manager must perform a comprehensive survey of the state and usage conditions of ICT resources, quickly assess problems or potential causes of problems, and take appropriate action. This comprehensive survey and prompt detection are made possible by operations visualization. Without visualization, efficient operation of private clouds may not be possible.

3. Needs for operations visualization

We have become aware of the following basic client needs related to operations management visualization for private clouds:
1) Promptly detecting problems that occur with lent out ICT resources

This issue refers to performance problems mainly. As mentioned in the previous section, a performance problem occurring in a VM may impact the other VMs supported by the same physical server. Therefore, it is necessary to quickly detect the cause of the disturbance and promptly address it.
2) Knowing the available capacity of ICT resources

This issue refers to the need to understand in a timely manner, for instance, how many GBs were lent out to the users and how many GBs are still available for users of all the disk capacities managed by the infrastructure management department. If there is insufficient capacity, the number of disks should be increased. However, because there is a time lag between placing an order and being able to use an additional disk after its delivery and installation, clients want to detect any sign of insufficiency at an early stage so that they can take appropriate action in advance.

4. Details of operations visualization

CT-MG and CIMS allow operations visualization for private clouds. In order to meet the requirements for visualization, two technologies are used; 1) Systemwalker Service Quality Coordinator (visualizes service quality) and 2) Interstage Business Process Manager Analytics (core dashboard product). With these technologies, information can be collected from various data sources and displayed in a comprehensive manner on a Web browser. The details of operations visualization provided by CT-MG and CIMS are described below. Further, each screen for visualization is indicated in **Figure 1**.

1) Visualization of resources

To visualize resources, information such as the CPU utilization, memory utilization and number of packets on the network are collected from a system program called "hypervisor" in the virtualization software ("VMware ESX server" for VMware). Information on these parameters is expressed in a line chart format on a daily basis. It is possible to set up the software so that an alert is sent via E-mail if any performance
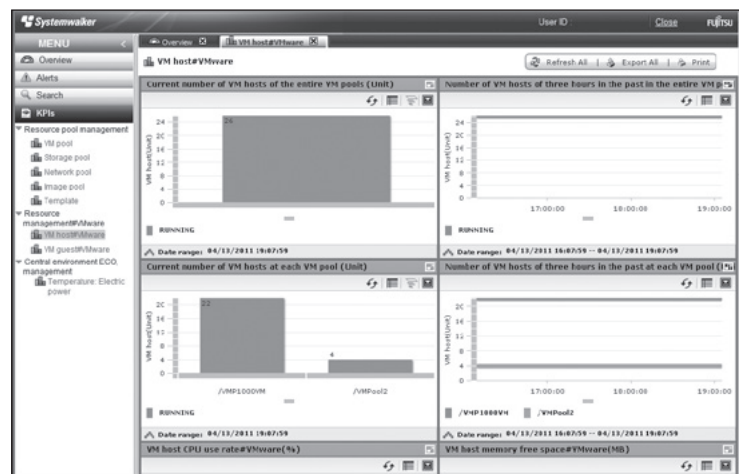
(a) Resources
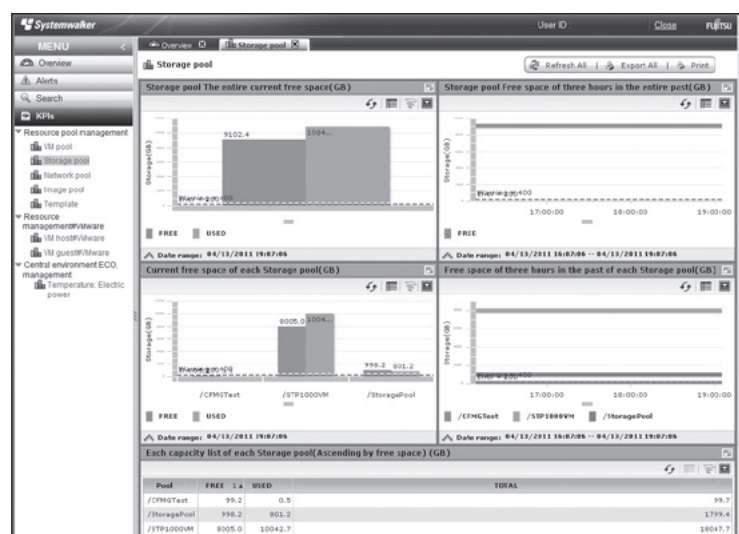
(b) Resource pools

Figure 1
Visualization functionality of Systemwalker Service Catalog Manager V14.1.

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value exceeds a prespecified threshold.

2)   Visualization of resource pools

Management of resource pools is carried out by ServerView Resource Orchestrator[5] (hereafter ROR).   With ROR, the server CPU, server memory, storage (disk) and network (IP address) are pooled for management.   Upon receiving a request to lend out a new VM, the necessary resources are cut out from the pools to construct a VM.

In visualizing resource pools, information on the resource pool management is collected and expressed as a circle graph, indicating the percentages of lent out resources and still available resources for each of the CPU, memory, disk and IP address.   Further, changes in resource usage during the last month are expressed as a line graph.   It is possible to set up the software so that an alert is sent to a system manager via E-mail if the available level of any resources becomes lower than a prespecified threshold.

5.   Future challenges

We plan to enhance the performance of CT-MG and CIMS with regard to their operations visualization by carefully incorporating customer needs in our development.   We will describe below the issues we are currently examining as we plan development of the next versions:

1)   Capacity planning

Capacity planning refers to the planning of an efficient arrangement or addition of resources based on analysis and simulation of accumulated data for resource usage (utilization of CPU and memory etc.).   For instance, to enhance the level of server integration, identical physical servers can be used for two VMs whose CPU utilization at peak time is 100% as long as their peak time is not the same.   Capacity planning involves analyzing which VM can be combined with which VM in arranging them on a physical server, based on past data such as CPU utilization or memory utilization.   Also, it may be possible to simulate

the utilizations of CPU or memory in future so that a system extension plan that efficiently handles peak time load can be developed.

Positive use of Business Intelligence (BI) tools is the key to successful analyses and simulations.   Linking the dashboard, which displays an outline of the tabulated data in one screen (list), and the BI tool is one of our future challenges.

2)   Linkage with other products

Some customers would like to use the dashboard as an integrated gate for virtualizing their comprehensive operations management tasks.   To address this need, it is essential to collect and display information from a wider range of products.

We consider that this can be achieved by customizing the dashboard.   For instance, we are considering doing this by establishing a linkage with BMC BladeLogic Server Automation[6] (BMC Software).   In this case, it is technically possible to display the results of a compliance check conducted by this product on the dashboard and allow the users to identify how many servers are in a non-compliant status.

Besides, some customers have expressed their need to display the incidence information managed by other products on the dashboard screen so that they can identify the presence of any emergency incident or the number of incidents on the queue.   Another issue for us to tackle in future is to facilitate linkage with other products by customizing the dashboard.

6.   Conclusion

In this paper, we explained the roles of operations visualization in the efficient operation of private clouds and the details of operations visualization provided by CT-MG and CIMS.

Operations visualization has become an essential function for the operation of private clouds, and various users have expressed needs for it.   Therefore, we are determined to make further efforts to offer products that

meet customers' expectations and improve the operational efficiency of their systems.

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