The Design of Personal Virtualization Rule Based on Context-Awareness in Environment of Cloud Computing

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Abstract. Cloud services are possible to consisting of personal service using service virtualization for user. However, this process set up a group of users, and has offers a group service of common structure by organized group than a service of personalized cloud. Therefore, this paper proposes a rule of virtualization to provide personalized service with optimal resources in cloud computing. Proposed rule constitute personalized service to fit the user's status by analyzing user's situation. A model for personalized service configuration is based on MLP(Multi-Layer Perceptron). And, it should ensure the connectivity of service using connection weights for link of each layer. A history of Matched service with served DR(Direct Relationship) reconstruct the user's context information by feedback. Thus, proposed rule provides personalized service automatically configured the information and application on user's situation.

Keywords: Cloud Computing, Personal Virtualization, Context-awareness, MLP(Multi-Layer Perceptron), Service.

1 Introduction

Cloud services are a technology that provides users virtualizing the physical resources and logical resources with system on a real-time; IaaS(Infrastructure as a Service), PaaS(Platform as a Service), SaaS(Software as a Service). These are required to provide optimized service environment according to the user's usage patterns. Also, cloud service provided to users should be monitored usage state of service and result continuously[1-3, 10, 11]. However, service resources in system manage and distribute by system administrator. Such being the case, system administrator must configure service virtualization every time whenever there is a new user access. Or, users must configure resources to service his needs. And it should attempt to manage continuous service resources about his needs for services. It has problem that disclosure of information due to wrong sharing resources[3, 4, 6]. Therefore, user can reduce utilization and accessibility for cloud services. So, cloud service must be configured according to user's context and state of system[5, 7].

This paper proposes a rule of optimized virtualization that to provide cloud service for user analyzing user's context and state of system. Proposed rule constitute a model

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using MLP(Multi-Layer Perceptron) to configuration of service. The input information of model is analyzed user's context information and DR(Direct Relationship) of service. In the hidden layer is to state information of system without your knowledge. The output layer is connected personal service between two layers by connection weight and DR. And this information is used for continuous forecasting information of service to get feedback into input layer. Also, the proposed rule uses a model of multi-agent to automate of service and to analyze of user's situation. The learning information of multi-agent is user's context information, provided service information and DR. This information is very important that to increase the reliability of service and to provide service appropriate for your situation. So, this paper measures the change of DR provided to user and connection of weight between state information of system and user's context information to affecting the decision of user's service. Also, we analyze influence of connection weight.

The rest of the paper is organized as follows. In section2, we are overview virtualization of cloud computing and context-awareness. We described proposed rule in detail in section 3. In section 4, the experimental results are shown and analyzed. Finally, a conclusion is given in section 5.

2 Related Work

2.1 The Virtualization of Cloud Computing

The cloud computing provide flexibility of service to support adaptive service virtualization with abstract from physical resource to logical resource [1-4]. Such as virtualization in cloud computing has 2 types; Type 1 is Hypervisor and Type2 is Hosted. And it divides virtualization as to system size and purpose of virtualization[10]. Especially, personalized cloud computing has to include mobility, adaptability and real-time. However, the right virtualization for mobile device cannot guarantee reliability and satisfying because of different type of OS [2- 4, 18]. And, for mobile virtualization don't have enough service resources as a processor, memory, storage, application and etc.

Recently, research of mobile virtualization has focused emphasis on development and research of virtualization in Android, Windows Mobile and iPhone. In case of [9], Guest OS invokes hypercall to return from exception and Xen restores the saved context. In [11, 14], they have been confirmed a problem to great overhead of performance than virtualize technical of exiting mobile. [6, 12] are to develop solution of virtualization for embedded system, developed VLX for mobile designed to operate on optimized structure without MMU in embedded system. In addition, other researchers are development and research to support GPOS in in Android, Windows Mobile and iPhone. [11] is solution of mobile virtualization to design based Xen. They designed Hypervisor that is responsible for scheduling and IPC between guests. [13, 14] developed mobile virtual machine based on micro kernel by Open Kernel Labs. It will ensure the reusability of the software because it is so designed as to run in both, Linux and RTOS. Also it is a structure for improved stability using micro kernel. [15] proposed technology of virtualization to divide with user address and kernel. It solved a problem that changes virtual address space to shift between host and guest. It has a hypervisor structure of built-in Linux kernel. Hypervisor

constructed such as process of hypercall, shadow paging, system call/exception and etc. Guest kernel has the part of virtual device and process in MyAV applied as well to divide address space with kernel and user. [16] is typical company's virtualization solutions, VMware's virtualization solutions developed by the mobile.

2.2 The Context-Awareness

Context-awareness is analysis technologies that to aware user situation such as location, time, user-status and ambient conditions with user and to provide intelligent service pursuant to the user contexts. The concept of context-awareness defines Schilit[19], Dey[18], Crowley[20], Pascoe[21] and others. Common points in their definition give shape to information of user situation and surrounding, monitoring them continuously, and managing Changed user information in real time. Also, their purposes are the design of context-awareness model that can be accurately analyzed user needs. Categorized context are used as input information of context-aware models and processing. And processed result provides service of available resources, recommended service, the requested service and others[22].

Recently, many researchers has been proposed multi-agent models combined with mobile computing environments using knowledge base contained social data and user's location data[8, 11, 17, 18]. Knowledge base designed a reasoning engine to support adaptive service for user and, using knowledge base of multi-agent analyzed context information from sensor around user. To support service multi-agent provides service device as a handhold device and a personal computer. And, learning of agent makes use such as Bayesian neural network, decision tree, export system and etc. In particular, the agent of network service should take advantage of the security policy measured by user's trust and reputation [3, 8, 9].

3 A Rule of Individual Virtualization

Recently, cloud service has been providing common structure of cloud virtualization to dissociate service each user. So that, these structure need model of service decision to

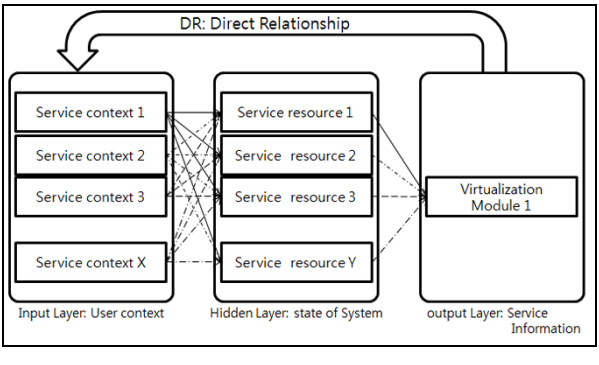

Fig. 1. The structure of personal service process applied to model of MLP

provide cloud service appropriate service to user considering the situation of user's and the status of system resources. Therefore, this paper proposes a rule of personal virtualization to redistribute resources of clouds service according to user's context. Proposed the rule of personal virtualization uses a structure of neural network (MLP) for recommend of virtualization service. MLP (Multi-Layer Perceptron) is a movement model possible parallel processing services that because consists of several layers. It is a suitable model on structure of cloud service to process various services, and possible to support dynamic service. In this paper has designed the state of system and user's context information to handle a cloud service requested by user in accord with MLP.

The proposed model enters user's context to input layer in MLP. This information is information(X_i) analyzed user's usage patterns, and is confirmed usage device of service to have users. The hidden layer of MLP enters information of system status. This layer is appropriate state information of system (Y_i) because it cannot check on information by user. Output layer is a module of personal virtualization combined user context information with state information of system. This module provides virtualization service to user and put feedback to input layer. Also, provided virtualization service put feedback to input layer assessing DR (Direct Relationship) between state information of system and user's context. And, to ensure strong connectivity between resources of input layer and resources of hidden layer calculates connection weight. The connection weight in this paper is defined as follows:

$$
\begin{aligned}
&\Delta W_{ji} = -\eta\frac{\partial E}{\partial W_{ji}} = -\eta\frac{\partial E}{\partial oi}\frac{\partial oi}{\partial \neq ti}\frac{\partial \neq ti}{\partial wji} = \eta(r_i - oi)f_i'(\neq t_i)o_j \\
&\frac{\partial E}{\partial oi} = -(r_i - oi) \qquad \frac{\partial oi}{\partial \neq ti} = f(\neq t_i) = f(1-f) \\
&\frac{\partial \neq ti}{\partial wji} = \frac{\partial}{\partial W_{ji}}\Sigma W_{ji}o_j = o_j \\
&\neq t_i = \Sigma W_{ji}o_j \\
&o_{i=f(\neq t_i)} \\
&\epsilon_i = -\frac{\partial E}{\partial \neq t_i} = -\frac{\partial E}{\partial oi}\frac{\partial oi}{\partial \neq ti} = (r_i - oi)f'(\neq t_i) \\
&\Delta W_{kj} = -\eta\frac{\partial E}{\partial W_{kj}} = -\eta\frac{\partial E}{\partial oi}\frac{\partial oi}{\partial W_{kj}} = -\eta\frac{\partial E}{\partial oi}\frac{\partial oi}{\partial \neq t_j}o_k \\
&\quad = \eta(-\frac{\partial E}{\partial o_j})f'(\neq t_j)o_k = \eta\Sigma_i\epsilon_i w_{ji}f'(\neq t_j)o_k = \eta\epsilon_j o_k \\
&\frac{\partial E}{\partial o_j} = \Sigma\frac{\partial E}{\partial \neq t_i}\frac{\partial \neq t_i}{\partial o_j} = \Sigma_i\epsilon_i w_{ji} \\
&\epsilon_j = -\frac{\partial E}{\partial \neq t_j} = -\frac{\partial E}{\partial o_j}\frac{\partial o_j}{\partial \neq t_j} = \Sigma_i\epsilon_i w_{ji}f'(\neq t_j)
\end{aligned}
\tag{1}
$$

Adjustment values of connection weight at each layer shall be the average of correlation rate(∂E) calculated with matched resources by layer weights and virtualization service(∂o_X) requested by user of cloud service. And, the result affect change of connection weight between service resources and user situation by update learning rate (η). Learning rate learns processing of service virtualization to fit user context and eliminating redundancy of user services. Associated virtualization service in this way associates user context with service resources of cloud computing dynamically in level of abstract. For update of virtualization service uses Multi-linear regression to reflect changed DR. DR in multi-linear regression is inclusion relation

between information by connection weight. This relation information uses to critical information for user reasoning of virtualization services in next time. DR between state of system and user context feedback in multi-linear regression. This information has a value type of sin, and should respond to a state of system dynamically. And it is upgrade DR and connection weight by redefining the relationship. For this, Multi-linear regression is defined as follow:

$$UC_X^Y(C) = \alpha + (\sin(SC_Z^Y(C)) * (DR_X^Z(C) * |SC_Z^Y(C)| + (1 - DR_X^Z(C)) * (1 - |SC_Z^Y(C)|))) \quad (2)$$

Multi-linear regression includes a function of reasoning for virtualization service according to user situation. α is calculated connection weight in MLP. $\sin(SC_Z^Y(C))$ is feedback value of estimated $SC_Z^Y(C)$ from allocated service virtualization and state of system. And, it should include dependent changes in virtualization service. $DR_X^Z(C)$ means DR of mapped virtualization by connection weight of layers. It should include correlation between information of user context and state information of system. So, analyzed result forms strong mapping relation between information of user context and cloud resources. It was partial differential from equation (2), and is defined as follows:

$$UC_X^Y(C) = n\alpha + \frac{\sum_{z=1}^{n} (UC_X^Y(C)_Z * DR_X^Z(C))}{\sum_{z=1}^{n} DR_X^Z(C)} \quad (3)$$

$n\alpha$ is proposed DR of virtualization service according to user situation. This value will be granted high reliability about provided service to user. $UC_X^Y(C)_z$ will be evaluated correlation between information of user context and provided state value(Z) of virtualization service to user. In other word, feedback information is a dependent variable to determine the resources conform to user context, and is automatically selected resources needed for virtualization service conform to user context and the maps resources. Also, to supplement the recommendation, we calculate periodically condition index about information of feedback and user context. The condition index should be informed shortage of physical resources to system administrator compared with the full utilization in service resources of system. Thus, system administrator can achieve further scarce resources.

4 Experiment and Evaluation

All the experiments run on a Core i5 CPU 2.8-GHz machine with 4-G RAM. The data for experiments use MovieLens Datasets for analysis of user's context. And state information of cloud system received state information of system from virtual server. The number of experiments was conducted 100 times. The First, analyzed the correlation between layers is as follows:

$P_{VC}(\theta)$ is based on the user's context data, means correlation between provided service virtualization and state information of system. It has an independent relationship with user's context and state information of system. And it has a high correlation with DR to provide a service to users. $P_{SC}(\theta)$ is based on the state

information of cloud system, means correlation between provided service virtualization and user's context data. System has negative correlation with the user's context data. To allocate resources of system has nothing to do with the user's context data. So, it has problem that waste the resources of system. $P_{DR}(\theta)$ means correlation between user's context data and state information of system. It has feedback to user's context data, and then will update correlation between information. And it has a strong positive correlation with the user's context data and state information of system. Through this process, system can be optimizing of service virtualization for user with learning by proposed rule continuously. Thus, proposed rule can infer and distribute service resources to fit user according to user's usage patterns.

Table 1. The association relationship with UC(User Context), SC(System Context), DR(Direct Relation)

	$P_{UC}(\theta)$	$P_{SC}(\theta)$	$P_{DR}(\theta)$
UC_X^Y	1	0.05	0.974
SC_Z^Y	0.05	1	0.931
DR_X^Z	0.974	0.931	1

Next, in order to evaluate DR included connection weight and user context, we measure the utilization rate provided to user during 100 times. As shown in figure, service resources configured into five provide service virtualization according to user's set during early. Because has been used irregularly by user and different services that use the resources according to user usage patterns. However, the number of approaches over 30 times, proposed rule is performed reasoning and selection about service resources by learning the user situation. Therefore, user should provide service to fit user situation, and system should performed automatically service virtualization.

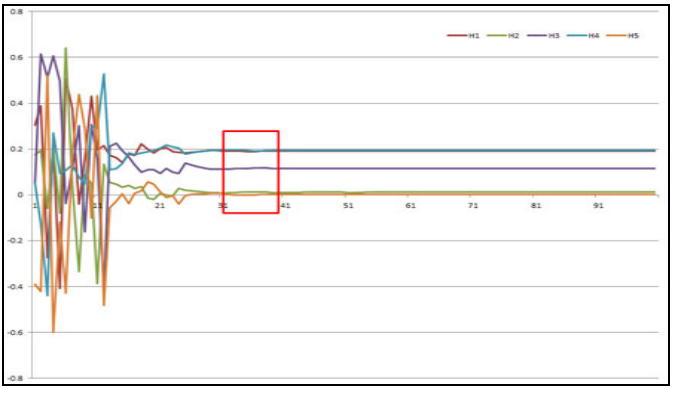

Fig. 2. User of the system resource utilization rate. System resource utilization rate is the interval [-1, 1]. -1 system resource use closer to small number of times, and + 1, the closer the frequently used system resource.

5 Conclusion

This paper proposed a rule of personalized virtualization according to user usage patterns in cloud service. The proposed rule provide virtualization service necessary user by learning user context. Allocation of service resources to fit user decides information such as condition index, feedback of learning data, DR included connection weight and correlation between a user's context and state of system. These define happening relationships between user context and status of system on MLP, and calculate. During early, relation between input layer and hidden layer was confirmed relation of user request resources. However, increasing number of experiments was changed to a strong correlation increasing the DR by learning information of each layer.

Thus, to use user context in the proposed rule can configure differentiated cloud service according to user usage patterns. And the proposed rule can be reasoning of cloud service by learning user situation consistently in next time. Also, it can have environment of optimized service while preventing the waste of resources. Future research area, we evaluate dependence of resources to provide service and to build service virtualization. And, we will evaluate to provide cloud service constructing multi-agent system on proposed rule.

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