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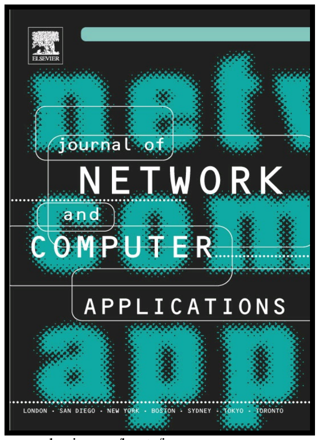

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Virtual Machine Management System based on the Power Saving Algorithm in Cloud

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Abstract

This work uses the open source codes and PHP web programming to implement a resource management system with power saving method for virtaul machines. We propose a system integrated with open source software, such as KVM and Libvirt, to construct a virtual cloud management platform. This system can detect the status of cloud resources via SNMP, calculate the operation efficiency of the overall system, allocate virtual machines through the live migration technology, and turn off extra machines in the cloud to save energy. According to our proposed power saving method, we have constructed a power efficient virtualization management platform in the cloud. Our objective is to provide enterprises or end users with power saving private cloud solutions. In this work we also have built a web page to allow users to easily access and control the cloud virtualization resources, i.e., users can manage virtual machines and monitor the status of resources via the web interface. From analysis of the experimental results of live migration of virtual machines, this work demonstrates that efficient use of hardware resources is realized by the power saving method, and the aim of power saving for cloud computing is achieved.

Keywords

Power saving; VM management; Live migration; Virtualization; Cloud IaaS;

I. Introduction

Cloud computing, one of today's hottest topics, has being developed very fast. Many large cloud companies, such as Google, Amazon, Yahoo, offer multiple cloud services and have a large number of users. In order to provide these services, the cloud infrastructure grew nearly 42.4 percent in 2012, and is expected to grow nearly 47.3 percent in 2013. A large cloud infrastructure usually includes cloud servers and cloud storage. The global cloud infrastructure is estimated to consume about 30 billion kilowatts of electricity in one hour, but 90 percent of it is wasted due to inefficient use of cloud resources; hence, how to reduce electricity consumption waste on the cloud infrastructure is a topic worth exploring.

Cloud computing is a concept, in which computers over networks are able to cooperate with each other to provide far-reaching network services [1]–[6]. The basic approach to computing through the Internet by terminal operations of cloud computing moves hardware, software, and shared information from users to the server side; in this way, the original waste of redundant resources on personal computers is evaded to improve computing and resource efficiency [7]–[14].

For increasingly high demand of the cloud today, a typical application of cloud computing is the large-scale data center, which operates with tremendous amount of power consumption [15]–[23]. The power consumption of large data centers today shares about 0.5% of the global carbon emissions; with the deepening of cloud computing in the future, it is predicted to account for 2%, which represents carbon emissions of large data centers of some large enterprises, and may even beyond 2% for some countries. Such huge amount of power consumption, especially with today's emphases on power conservation and carbon reduction, is a major problem that cannot be ignored. How to maintain the growth of cloud computing technology, but also take into account of the efficiency of power usage, comprises the main research direction of this work.

The energy demand of the cloud environment issues cannot be ignored [24]–[39]. Through live migration of the virtual machine (VM) technology, the need to postpone and restart servers for operations is eliminated and the purpose of power-saving is achieved. However, if one only partially focuses on the VM side, the quality of service in the cloud environment is rendered to reduce, contrary to the intent of the cloud computing. In the commercial cloud computing environment, emphasis is on the service-level agreement (SLA). An effective management tools can help the service provider and the client using services with satisfying service level expectations of each other; in other words, it can help enterprises to construct channels of communication with communication plans to establish consistency and reduce conflicts, and methods to measure service performance [40]–[48]. In [39], an architecture design for virtual machine management in cloud is implemented. The authors applied the open source codes and PHP web programming to implement a resource management system integrated with open source software, such as KVM and Libvirt, to construct a virtual cloud management platform. Their system can detect the status of cloud resources via SNMP and turn off extra machines in the cloud to save energy. However, power consumption model in migration and the corresponding power-saving method are not listed. In addition, they don't breftly explain how to