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Network-Aware Virtual Machine Migration in an Overcommitted Cloud

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Abstract

Virtualization, which acts as the underlying technology for cloud computing, enables large amounts of third-party applications to be packed into virtual machines (VMs). VM migration enables servers to be reconsolidated or reshuffled to reduce the operational costs of data centers. The network traffic costs for VM migration currently attract limited attention.

However, traffic and bandwidth demands among VMs in a data center account for considerable total traffic. VM migration also causes additional data transfer overhead, which would also increase the network cost of the data center.

This study considers a network-aware VM migration (NetVMM) problem in an overcommitted cloud and formulates it into a non-deterministic polynomial time-complete problem. This study aims to minimize network traffic costs by considering the inherent dependencies among VMs that comprise a multi-tier application and the underlying topology of physical machines and to ensure a good trade-off between network communication and VM migration costs.

The mechanism that the swarm intelligence algorithm aims to find is an approximate optimal solution through repeated iterations to make it a good solution for the VM migration problem. In this study, genetic algorithm (GA) and artificial bee colony (ABC) are adopted and changed to suit the VM migration problem to minimize the network cost. Experimental results show that GA has low network costs when VM instances are small. However, when the problem size increases, ABC is advantageous to GA. The running time of ABC is also nearly half that of GA. To the best of our knowledge, we are the first to use ABC to solve the NetVMM problem.

Keywords: *Cloud computing, Network-aware virtual machine migration, Network communication costs, Migration costs, Genetic algorithm, Artificial bee colony algorithm*

1. Introduction

Cloud computing is a newly emerged pay-as-you-go utility model that is currently receiving considerable attention from academia and industry. Virtualization, which is the abstraction of logical resources from their underlying physical resources, serves as the technology support for cloud computing. Big data centers comprise large amounts of third-party applications. By packing these applications into virtual machines (VMs), virtualization enables these third-party applications to be reconsolidated onto other servers according to server-side resources and workloads, thereby contributing to significant cost savings.

The most commonly used server consolidation method is energy-aware VM migration, which aims to consolidate as many VMs into servers as possible to improve the utilization of each server and to switch the unused servers to a low-power state. As a result, energy can be

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