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Power-aware Performance Analysis of Self-Adaptive Resource Management in IaaS Clouds

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Abstract

In this paper, Stochastic Activity Networks (SANs) are used to model and evaluate the performance and power consumption of an Infrastructure-as-a-Service (IaaS) cloud. The proposed SAN model is scalable and flexible, yet encompasses some details of an IaaS cloud, such as Virtual Machine (VM) provisioning, VM multiplexing, and failure/repair behavior of VMs. Using the proposed SAN, a power-aware self-adaptive resource management scheme is presented for IaaS clouds that automatically adjusts the number of powered-on Physical Machines (PMs) regarding variable workloads in different time intervals. The proposed scheme respects user-oriented metrics by avoiding Service Level Agreement (SLA) violations while taking provider-oriented metrics into consideration. The behavior of the proposed scheme is analyzed when the arriving workload changes, and then its performance is compared with two non-adaptive baselines based on diverse performance and power consumption measures defined on the system. A validation of the proposed SAN model and the resource management scheme against an adapted version of the CloudSim framework is also presented.

Keywords: IaaS cloud, self-adaptive resource management, service level agreement, stochastic activity network.

1. Introduction

Cloud computing has attracted great popularity in recent years. Infrastructure as a Service (IaaS) is one of the most popular types of services that clouds offer. In IaaS, low-level computing resources are delivered to customers in the form of Virtual Machines (VMs).

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