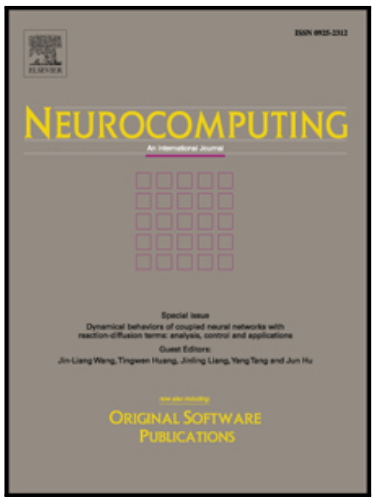

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Fault-tolerant System Design on Cloud Logistics by Greener Standbys Deployment with Petri Net Model

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Abstract

The cost-aware exploration on enhancing fault-tolerant becomes an important issue of service quality from cloud platform. To approach this goal with greener design, a novel server backup strategy is adopted with two types of standby server with warm standby and cold standby configurations. On such two-level standby scheme, cost elaboration has been explored in terms of deployment ratio between warm standbys and cold standbys. The cold standbys provide a greener power solution than those of conventional warm standbys. The optimal cost policy has been proposed to maintain regulated quality of service for the cloud customers. On qualitative study, a Petri Net is developed and designed to visualize the whole system operational flow. On quantitative research for decision support, the theory of finite source queue is elaborated and relevant comprehensive mathematical analysis on cost pattern has been made in detail. Relevant simulations have been conducted to validate the proposed cost optimization model as well. On green contribution, the saving of power consumption has been estimated on the basis of switching warm standbys into cold standbys, which amounts for the reduction of CO_2 emission. Hence the proposed approach indeed provides a feasibly standby architecture to meet cloud logistic economy with greener deployment.

Keywords: cloud computing, fault-tolerant system, Petri nets, cost optimization.

1. Introduction

The cloud environment has gained the popularity to be the mainstream platform of transforming a large part of the IT industry, making software more attractive as a service and shaping the way IT hardware is designed and purchased [1][2]. With the ever-increasing market requirement of the cloud platforms, the system design on resource management attracts more attention from both industry and academia. The field of high-reliability, high-availability, fault-tolerant computing was developed for the critical needs of military and space applications. Fault-tolerant computing is a generic term describing redundant design techniques with duplicate components enabling uninterrupted service in response to component failure [3]. To counter the influence of faulty components, it is absolutely required to alleviate unavoidable impact from server breakdowns during service. Hence, the cloud logistics needs an optimization design or cost model on the spare profile for the long-term management need of the cloud platform [4~6].

The standby concept is the basic scheme to maintain operation with regulated quality of service (QoS)