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AN ADAPTIVE TRUST BASED SERVICE QUALITY MONITORING MECHANISM FOR CLOUD COMPUTING

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DOCTOR OF PHILOSOPHY
UNIVERSITI UTARA MALAYSIA
2016
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Abstrak


Kata kunci: Pengkomputeran awan, Pemantauan kualiti perkhidmatan, Pengkuantitian kualiti perkhidmatan, Pengkomputeran kepercayaan, Pengagihan kepercayaan
Abstract

Cloud computing is the newest paradigm in distributed computing that delivers computing resources over the Internet as services. Due to the attractiveness of cloud computing, the market is currently flooded with many service providers. This has necessitated the customers to identify the right one meeting their requirements in terms of service quality. The existing monitoring of service quality has been limited only to quantification in cloud computing. On the other hand, the continuous improvement and distribution of service quality scores have been implemented in other distributed computing paradigms but not specifically for cloud computing. This research investigates the methods and proposes mechanisms for quantifying and ranking the service quality of service providers. The solution proposed in this thesis consists of three mechanisms, namely service quality modeling mechanism, adaptive trust computing mechanism and trust distribution mechanism for cloud computing. The Design Research Methodology (DRM) has been modified by adding phases, means and methods, and probable outcomes. This modified DRM is used throughout this study. The mechanisms were developed and tested gradually until the expected outcome has been achieved. A comprehensive set of experiments were carried out in a simulated environment to validate their effectiveness. The evaluation has been carried out by comparing their performance against the combined trust model and QoS trust model for cloud computing along with the adapted fuzzy theory based trust computing mechanism and super-agent based trust distribution mechanism, which were developed for other distributed systems. The results show that the mechanisms are faster and more stable than the existing solutions in terms of reaching the final trust scores on all three parameters tested. The results presented in this thesis are significant in terms of making cloud computing acceptable to users in verifying the performance of the service providers before making the selection.

Keywords: Cloud computing, Service quality monitoring, Service quality quantification, Trust computing, Trust distribution
Declaration

Some of the works presented in this thesis have been published or submitted as listed below.

**Book Chapters**


**Journal Articles**


Conference Papers


Acknowledgments

In the name of Allah the Most Beneficent, the Most Merciful.

Studying towards a PhD, though it is very rewarding at the end, it is a very tedious and challenging journey. I have almost reached the end of it with a lot of effort, blood, sweat and tears. There are several people, who helped to reach this stage successfully. I will fail in my duty, if I do not give them the credit that is rightfully due to them.

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<tr>
<td>ACTEM</td>
<td>Adaptive Continuous Trust Evolution Mechanism</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
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<tr>
<td>AWS</td>
<td>Amazon Web Services</td>
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<td>CDO</td>
<td>Cloud Deployment Options</td>
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<td>CSP</td>
<td>Cloud Service Provider</td>
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<tr>
<td>DRM</td>
<td>Design Research Methodology</td>
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<tr>
<td>DS-I</td>
<td>Descriptive Study I</td>
</tr>
<tr>
<td>DS-II</td>
<td>Descriptive Study II</td>
</tr>
<tr>
<td>FBCT</td>
<td>Family-gene Based model for Cloud Trust</td>
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<tr>
<td>FIFO</td>
<td>First In First Out</td>
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<tr>
<td>GUT</td>
<td>Graphical User interface</td>
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<td>HystTrust</td>
<td>Hysteresis-based Trust Evolution Mechanism</td>
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<tr>
<td>IaaS</td>
<td>Infrastructure as a Service</td>
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<td>IdP</td>
<td>Identity Policy</td>
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<tr>
<td>IdPS</td>
<td>Identity Practice Statement</td>
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<tr>
<td>IDE</td>
<td>Integrated Development Environment</td>
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<td>ISO</td>
<td>International Standards Organization</td>
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<td>JVM</td>
<td>Java Virtual Machine</td>
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<td>KPI</td>
<td>Key Performance Indicators</td>
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<td>MemTrust</td>
<td>Memoryless Trust Computing Mechanism</td>
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<td>MP-SQQM</td>
<td>Multi-Parameter Service Quality Quantification Mechanism</td>
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<tr>
<td>MTCEM</td>
<td>Multi-tenancy Trusted Computing Environment Model</td>
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<td>MuDTComM</td>
<td>Multi-Dimensional Trust Computing Mechanism</td>
</tr>
<tr>
<td>PaaS</td>
<td>Platform as a Service</td>
</tr>
<tr>
<td>PERMIS</td>
<td>PrivilEge and Role Management Infrastructure Standard</td>
</tr>
<tr>
<td>PS</td>
<td>Prescriptive Study</td>
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<tr>
<td>PSO</td>
<td>Particle Swarm Optimization</td>
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<td>PTDiMech</td>
<td>Probability-based Trust Distribution Mechanism</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>QoE</td>
<td>Quality of Experience</td>
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<td>QoS</td>
<td>Quality of Service</td>
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<td>RAM</td>
<td>Random Access Memory</td>
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<td>RATComM</td>
<td>Robust Adaptive Trust Computing Mechanism</td>
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<td>RC</td>
<td>Research Clarification</td>
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<td>S3</td>
<td>Simple Storage Service</td>
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<tr>
<td>SaaS</td>
<td>Software as a Service</td>
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<td>SLA</td>
<td>Service Level Agreement</td>
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<td>SMI</td>
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<td>Service Practice Statement</td>
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<td>Single Parameter Service Quality Quantification Algorithm</td>
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<td>Single Parameter Service Quality Quantification Mechanism</td>
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<tr>
<td>TSS</td>
<td>Trusted Platform Software Stack</td>
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<td>VM</td>
<td>Virtual Machine</td>
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<td>VMM</td>
<td>Virtual Machine Manager</td>
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CHAPTER ONE
OVERVIEW

1.1 Introduction

This chapter presents a brief introduction to the proposed research along with the general background information on cloud computing in brief including its features, advantages, disadvantages and issues. The chapter also outlines the problem statement and research questions, research motivation, research objectives, research scope and the significance of the research along with the contributions. Finally the outline of the proposal is presented at the end.

1.2 Background

Cloud computing has become very popular among the computing community in the recent years. It has already has earned the nickname the 5th utility due to its versatile and economic way of making resources available over the Internet [1]. Utilities make the resources available to a wider clientele and charge them only for the usage. Electricity, water, gas and telephony are the four major utilities that have been commonly used in this manner before the arrival of cloud computing. Prior to the emergence of cloud computing in the latter part of the 1st decade of 2000s, computing resources such as hardware including processor power, storage, networks bandwidth were either purchased outright and installed in the data centers owned and operated by end users themselves or leased from public data centers on fixed monthly or annual charges [2]. The clients installed the operating systems, tools and applications of their choice on these hardware dedicated only for their use. Once the hardware has been purchased or leased in this manner, the capacity of these systems were fixed irrespective of usage. The computing resources thus installed in clients’ data centers are generally underutilized. Recent surveys have found that in many data centers the
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REFERENCES


