

**DEVELOPMENT OF AN AUTOMATED SERVICE LEVEL
AGREEMENT NEGOTIATION FRAMEWORK FOR SAAS
CLOUD E-MARKETPLACE**

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AUGUST, 2023

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BY

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF
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THE REQUIREMENTS FOR THE AWARD OF MASTER OF
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SCIENCES, COLLEGE OF SCIENCE AND TECHNOLOGY
COVENANT UNIVERSITY, OTA, OGUN STATE, NIGERIA**

AUGUST, 2023

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the degree of Master of Science in Computer Science in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria.

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CERTIFICATION

We certify that this dissertation titled “**DEVELOPMENT OF AN AUTOMATED SERVICE LEVEL AGREEMENT NEGOTIATION FRAMEWORK FOR SAAS CLOUD E-MARKETPLACE.**” is an original research work carried out by NNAJI, UCHE JOSIAH (21PCG02289) in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Azubuike Ezenwoke, Ph.D. We have examined and found this work acceptable as part of the requirements for the award of Master of Science (M.Sc.) in Computer Science.

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DECLARATION

I, **NNAJI, UCHE JOSIAH (21PCG02289)**, declare that this research was carried out by me under the supervision of Azubuike Ezenwoke, Ph.D. of the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

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Signature and Date

DEDICATION

With boundless gratitude, I dedicate this work to the Almighty God for His limitless wisdom, grace, unmerited favour, and unwavering love, guiding every step of my journey.

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LIST OF ABBREVIATIONS

ACL	Agent Communication Language
ANP	Analytic Network Process
ASV	Aggregated Satisfaction Value
CCSN	Cloud Computing Service Negotiation
CLI	Command-Line Interface
CNA	Consumer Negotiator Agent
CP	Counterproposal
CSPs	Cloud Service Providers
DSR	Design Science Research
DSS	Decision Support System
ER	Evaluation Results
GUI	Graphic User Interface
IAAS	Infrastructure-as-a-Service
JADE	Java Agent Development Environment
JVM	Java Virtual Machine
MAS	Multi-Agent Systems
MAUT	Multi-attribute Utility Theory
NIST	National Institute of Standards and Technology
PAAS	Platform-as-a-Service
PNA	Provider Negotiator Agent
QOS	Quality of Service
SAAS	Software-as-a-Service
SLA	Service Level Agreement
TOPSIS	Technique for order preference by similarity to ideal solution
VMs	Virtual Machine

ABSTRACT

With the rising number of Software-as-a-Service (SaaS) users, meeting their diverse needs while maintaining Quality of Service (QoS) has become crucial. SaaS providers continually offer new applications with different offerings and QoS parameters, but individual user QoS requirements can be overlooked in the current Cloud e-marketplace. To address this, Service Level Agreement (SLA) negotiations are used for cloud service selection and to guarantee SaaS user satisfaction, often facilitated by brokers. These brokers ensure optimal offers from providers, considering the user's preferences. Brokers ensure that before an agreement is initialized, cloud providers are ranked, and negotiation occurs only if the user does not accept the offer of the best provider. Selecting the most suitable provider and negotiating these QoS parameters can be a complex task for brokers given the high number of users and providers. This paper aims to present a negotiation framework that increases the customer satisfaction value of SaaS users using a service broker. The proposed framework leverages multi-agent systems (MAS) as the methodology for our proposed negotiation framework. By adopting this proposed negotiation framework, SaaS users can get services from providers that can meet their specific requirements. The experimental results obtained during the simulation show that the proposed framework performs better in terms of the level of satisfaction, response time, and success rate of negotiation compared to previous studies.

Keywords: *Multi-agent system, SaaS, Cloud e-marketplace, Service ranking, SLA negotiation.*