UTS UNIVERSITY OF TECHNOLOGY SYDNEY

A Framework for SLA Management in SOA-based SDN for Informed Decision Making

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CERTIFICATE OF ORIGINAL AUTHORSHIP

I, *Shuraia Khan*, declare that this thesis is submitted in fulfilment of the requirements for the award of *Doctor of Philosophy* in the *School of Computer Science, Faculty of Engineering and IT* at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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Thesis Summary

Supporting end-to-end Quality of Services (QoS) in existing network architecture is an ongoing issue. Software Defined Networking (SDN), the new network norm, has emerged in response to the limitations of traditional networks. SDN architecture incorporating Service Oriented Architecture (SOA) brings a network notion of a future service-oriented network. Supporting high dependency on intelligent applications is gradually increasing the demand for high-capacity networks with QoS delivery is vital. The absence of ensuring QoS leads to less reliability and a lower level of trust among the interacting parties, which can significantly impact service-based business. In order to address the pressing issues, the existing studies proposed various solutions; however, most of the solutions are application-based and unable to provide a reliable and personalised QoS guarantee in the SDN network. Moreover, no research has been proposed to provide QoS of future Service Oriented SDN. In order to ensure personalised QoS delivery and enhance to preserve the trust relationships, we have proposed Service Level Agreement (SLA) based framework in SOA-based SDN.

The proposed SLA-based framework in SOA-based SDN should address a series of important research questions: (1) How to develop an intelligent method for personalised QoS delivery in SOA-based SDN? (2) How to monitor the QoS of the runtime services in SDN network and pro-actively predict the SLA violation to minimise the risk of SLA violation? (3) How to evaluate the service performance impartially and guarantee a reliable service delivery in SOA-based SDN? (4) How to make an intelligent decision regarding service continuation in considering the deliverable service performance during interactions?

This thesis systematically studies how to effectively solve the aforementioned issues with conceptual, theoretical and experimental guarantees. Due to the significance of the aforementioned issue on SOA-based business, it is essential to determine a process that can preserve the SLA contract and trust relationship between the interacting parties. Specifically, this thesis proposes a novel framework SLA-lifecycle-based model to address the issue mentioned above. The primary feature of the framework is that it enables personalised and

reliable QoS delivery in SOA-based SDN. In addition, the intelligent framework approach can monitor the network in run-time and predict the possible SLA violation; that information also assists in intelligent decision-making regarding the continuation of the SLA. To validate the framework, we have developed a proof of concept (POC) based implementation including various components such as tools and simulation software and expressed the results with discussion in this thesis.

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List to Publications

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2. Shuraia Khan, Farookh Khadeer Hussain, "*Software-Defined Overlay Network Implementation and Its Use for Interoperable Mission Network in Military Communications.*" Proceedings of the 36th International Conference on Advanced Information Networking and Applications AINA (1) 2022: 554-565.

3. Shuraia Khan, Farookh Khadeer Hussain, *"Evaluation of SLA Negotiation for Personalized SDN Service Delivery."*, Proceeding of the 34th International Conference on Advanced Information Networking and Applications AINA 2020: 579-590.

4. Shuraia Khan, Farookh Khadeer Hussain, *"A SOA based SLA negotiation and formulation architecture for personalized service delivery in SDN."*, Proceeding of the 22nd International Conference on Advances in networked-based Information Systems(NBIS) 2020: 108-119.

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