UNIVERSITI PUTRA MALAYSIA

CUSTOM WINDOWS PERFORMANCE COUNTERS MONITORING MECHANISM FOR MEASURING QUALITY OF SERVICE ATTRIBUTES AND STABILITY COEFFICIENT IN SERVICE-ORIENTED ARCHITECTURE

BAHAREH SADAT ARAB

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By

BAHAREH SADAT ARAB

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

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To my family

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Chairman: Professor Abdul Azim Abd. Ghani, PhD

Faculty: Computer Science and Information Technology

Service-Oriented Architecture (SOA) has been widely used for different types of systems as their underlying architecture. The most popular technology that implements the SOA is web service. When several web services provide same functionalities, Quality of Service (QoS) of web services turn to be an important issue. In this study, monitoring is used in order to measure QoS attributes of web services in SOA.

Several monitoring mechanisms have been proposed. Windows Performance Counters (WPC) is one of approaches for monitoring services at provider-side. However, WPC monitoring approach has a limitation and it can be employed just for WCF services. Moreover, predefined system counter values do not map to QoS values properly.

In this research, a new provider-side monitoring mechanism which is based on Custom Windows Performance Counters (CWPC) is proposed in order to overcome current limitations. CWPC will be set to measure QoS attributes of web services such as response time, throughput and reliability properly. The results of CWPC monitoring are useful in taking decision in adjusting suitable monitoring interval for the system. Additionally, the result verifies that CWPC is an accurate monitoring approach for measuring QoS attributes.

Besides that, this study also focuses on variability of QoS values which are obtained by monitoring of web services at different service invocation time. QoS values are variable and service consumers may experience various QoS values due to the fact that web services run in a distributed, dynamic, and unreliable environment which makes them exposed to faults and failures. In this research, a new Stability Coefficient is introduced to measure stability of a service based on historical QoS values that were obtained by monitoring the web service. Such a measure enables service consumers to find a stable and trustable service based on QoS attributes and it can increase consumer's satisfaction. In this study, the Stability Coefficient is defined based on an average of different QoS attributes of service stability. The results confirm that the proposed Stability Coefficient is a proper criterion for determining stability of services in terms of their QoS attributes and a stable service with less QoS values variation has a high Stability Coefficient which may lead to more satisfaction to service consumer.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PEMBILANG PRESTASI TETINGKAP MENGIKUT KEADAAN SEBAGAI MEKANISMA PEMANTAUAN UNTUK MENGUKUR ATRIBUT KUALITI PERKHIDMATAN DAN KOEFFISYEN KESTABILAN DALAM SENIBINA BERORIENTASI PERKHIDMATAN

Oleh

BAHAREH SADAT ARAB

Disember 2010

Pengerusi: Prof. Abdul Azim Abd. Ghani, PhD

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Senibina Berorientasikan Perkhidmatan (SBP) telah digunakan secara meluas untuk sistem yang berlainan jenis sebagai senibina asas. Teknologi yang paling popular mengimplementasi SBP ialah perkhidmatan web. Apabila beberapa perkhidmatan web menyediakan fungsi yang sama, Kualiti Perkhidmatan (KP) perkhidmatan web menjadi isu penting. Dalam kajian ini, pemantauan digunakan untuk mengukur atribut perkhidmatan web dalam SBP.

Beberapa mekanisma pemantauan telah dicadangkan. Pembilang Prestasi Tetingkap (PPT) ialah salah satu pendekatan untuk memantau perkhidmatan di pihak pembekal. Walaubagaimana pun, pendekatan pemantauan PPT menpunyai kekurangan dan ianya hanya boleh digunakan untuk perkhidmatan WCF. Tambahan pula nilai pembilang sistem pratertakrif tidak dipeta ke nilai Kualiti Perkhidmatan sewajarnya.

Dalam penyelidikan ini, mekanisma baharu pemantauan pihak pembekal berdasarkan Pembilang Prestasi Tetingkap Mengikut Keadaan (PPTMK) dicadangkan untuk mengatasi kekurangan semasa. PPTMK akan disetkan sewajarnya untuk mengukur atribut KP perkhidmatan web seperti masa tindak balas, daya pemprosesan, dan kebolehpercayaan. Keputusan pemantauan PPTMK adalah berguna dalam mengambil keputusan untuk melaraskan interval pemantauan sistem yang sesuai. Selain itu, keputusan mengesahkan bahawa PPTMK ialah pendekatan pemantauan yang tepat untuk mengukur atribut KP.

Disamping itu, kajian ini juga memfokus kepada keberubahan nilai KP yang diperoleh melalui pemantauan perkhidmatan web di waktu panggilan berbeza perkhidmatan. Nilai KP adalah berubah dan pengguna perkhidmatan mungkin mengalami perubahan pelbagai nilai KP yang disebabkan oleh larian perkhidmatan web dalam suasana teragih, dinamik, dan tidak boleh dipercayai menyebabkan ianya terdedah kepada kegagalan dan kerosakan. Dalam penyelidikan ini, Koefisien Kestabilan diperkenalkan untuk mengukur kestabilan perkhidmatan berdasarkan kepada nilai sejarah KP yang diperoleh melalui pemantauan perkhidmatan web. Ukuran tersebut membenarkan pengguna perkhidmatan mencari perkhidmatan yang stabil dan boleh dipercayai berdasarkan atribut KP dan ia dapat menambahkan kepuasan pengguna. Dalam kajian ini, Koefisien Kestabilan ditakrif berdasarkan kepada purata kestabilan perkhidmatan atribut KP yang berbeza. Keputusan mengesahkan bahawa koefisien kestabilan yang dicadangkan ialah kriteria wajar untuk menentukan kestabilan perkhidmatan dalam sebutan nilai KP dan

perkhidmatan stabil dengan perbezaan nilai KP yang kecil mempunyai Koefisien Kestabilan tinggi yang menyebabkan lebih kepuasan kepada pengguna perkhidmatan.

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APPROVAL

I certify that a Thesis Examination Committee has met on 13 December 2010 to conduct the final examination of Bahareh Sadat Arab on her thesis entitled "Custom Windows Performance Counters Monitoring Mechanism for Measuring Quality of Service Attributes and Stability Coefficient in Service-Oriented Architecture" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirements for the degree of **Master of Science**. The members of the Supervisory Committee were as follows:

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institutions.

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BAHAREH SADAT ARAB

Date: 13 December 2010

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