UNIVERSITI PUTRA MALAYSIA

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STATIC AND SELF-SCALABLE FILTER RANGE SELECTION ALGORITHMS FOR PEER-TO-PEER NETWORKS

By

KWEH YEAH LUN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of Philosophy

July 2011

To My Parents…

Abstract of thesis presented to the Senate of the Universiti Putra Malaysia in fulfillment of the requirements for the degree of Doctor of Philosophy

STATIC AND SELF-SCALABLE FILTER RANGE SELECTION ALGORITHMS FOR PEER-TO-PEER NETWORKS

By

KWEH YEAH LUN

July 2011

Chairman: **Professor Mohamed Othman, PhD**

Faculty: **Computer Science and Information Technology**

In this research, problems on the selection of keys in peer-to-peer networks are investigated. The key selection is about finding the target key with k^{th} rank in a global file with n keys that are distributed evenly among p nodes with each node holding n/p keys in the peer-to-peer network. In the literature, there are many selection algorithms proposed for different network topologies. For peer-to-peer networks, Loo (2005) selection algorithm has been selected as the benchmark as it is an established algorithm that claimed to be the best proposed for this network. The research works were implemented by simulation in which it was used to identify the selection problem, implementation of the proposed algorithms and the measurement of the results. Two multiple selection algorithm, which are known as "static filter range selection algorithm" and "self-scalable selection algorithm" are proposed. These algorithms are based on the statistical knowledge about the uniform distribution nature of the data and arranged in certain order in the file. The selection algorithms can perform multiple selections concurrently to find multiple target keys with different predefined target

ranks. The static filter range selection algorithm uses a fixed filter range approach to locate the target key, in which the filter range is preset at the beginning of the searching process. The range will be adjusted and becomes narrower while ensuring the target keys are still within it as the process iterates until the keys have been found. The self-scalable selection algorithm uses dynamic range where the filter range is not preset and is determined by the algorithm itself based on the distribution and the values of the data in the global and local file. After that, the ranges are made smaller and smaller until the target keys are found. Four parameters have been applied in this research to measure the performance of the algorithm. These are number of rounds needed, number of messages needed, success rate and execution time. The static filter range selection algorithm and the self-scalable selection algorithm are able to reduce the number of rounds and the number of messages needed, increase the success rate but longer execution time compared to the Loo (2005) selection algorithm. The self-scalable selection algorithm is also able to reduce the number of rounds and the number of messages needed, increase success rate and shorten the execution time compared to static filter range selection algorithm with filter range 15000, 20000 and 25000.

Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan ijazah Doctor Falsafah

ALGORITMA STATIK DAN BOLEH-SKALA SENDIRI JULAT PENAPIS UNTUK RANGKAIAN PERANGKAI PADAN

Oleh

KWEH YEAH LUN

Julai 2011

Pengerusi: **Profesor Mohamed Othman, PhD**

Fakulti: **Sains Komputer dan Teknologi Maklumat**

Dalam penyelidikan ini, masalah untuk pemilihan kunci dalam rangkaian perangkai padan telah disiasatkan. Pemilihan kunci adalah berkaitan dengan pencarian kunci-kunci sasaran dengan kedudukan sasaran ke-*k* dalam sebuah fail global dengan *n* kunci yang ditaburkan secara sama rata di antara *p* nod dengan setiap nod memegang *n/p* kunci dalam rangkaian perangkai padan. Terdapat banyak algoritma pemilihan telah dicadangkan untuk topologi rangkaian yang berlainan dalam kepustakaan. Untuk rangkaian perangkai padan, algoritma pemilihan Loo (2005) telah dipilih sebagai sebab ia merupakan satu algoritma yang mantap dan didakwa yang terbaik dalam rangkaian ini. Kerja penyelidikan telah dilaksanakan dengan penyelakuan di mana ia digunakan untuk mengenalpasti masalah dalam pemilihan, pelaksanaaan cadangan algoritma-algoritma dan pengukuran keputusan-keputasan yang didapati. Dua algoritma pemilihan berbilang, iaitu "*static filter range selection algorithm*" dan "*self-scalable selection algorithm*" telah dicadangkan. Algoritma-algoritma ini adalah berdasarkan pengetahuan statistik mengenai data dalam taburan seragam dan disusunkan dalam tertib tertentu

dalam fail. Algoritma pemilihan dapat melaksanakan pemilihan berbilang secara serempak untuk mencari kunci sasaran berbilang dengan pratakrif kedudukan yang berbeza. "*Static filter range selection algorithm*" menggunakan julat penapis tetap untuk menentukan lokasi kunci sasaran, di mana julat penapis telah dipraset pada permulaan proses pencarian. Proses pencarian berulang dengan julat dilaraskan dan menjadi semakin sempit dengan kunci-kunci sasaran masih berada dalam julat tersebut sehingga kunci-kunci tersebut didapati. "*Self-scalable selection algorithm*" menggunakan julat dinamik di mana julat penapis tidak dipraset dan ditentukan oleh algoritma sendiri berdasarkan taburan dan nilai kunci-kunci dalam fail global dan setempat. Selepas itu, julat itu dikecilkan sehingga kunci-kunci sasaran didapati. Empat parameter telah diaplikasikan dalam penyelidikan ini untuk mengukur prestasi algoritma-algoritma tersebut. Mereka adalah bilangan pusingan yang diperlukan, bilangan mesej yang diperlukan, kadar kejayaan dan masa perlakuan. *"Static filter range selection algorithm"* dan *"self-scalable selection algorithm"* berupaya mengurangkan bilangan pusingan dan mesej yang diperlukan, meningkatkan kadar kejayaan dengan masa perlakuan yang lebih panjang berbanding dengan algoritma pemilihan Loo (2005). "S*elf-scalable selection algorithm*" juga dapat mengurangkan bilangan pusingan dan bilangan mesej yang diperlukan, meningkatkan kadar kejayaan dan memerlukan masa perlakuan yang lebih singkat berbanding kepada "*static filter range selection algorithm*" yang menggunkan julat penapis 15000, 20000 dan 25000.

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Kweh Yeah Lun

July 2011

I certify that a Thesis Examination Committee has met on 7 July 2011 to conduct the final examination of Kweh Yeah Lun on his thesis entitled "Static and Self-Scalable Selection Algorithms for Peer-to-Peer Network" in accordance with the University and University College 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 Doctor of Philosophy.

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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 currently, submitted for any other degree at Universiti Putra Malaysia or other institutions.

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KWEH YEAH LUN

Date:

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