UNIVERSITI PUTRA MALAYSIA

RELIABILITY PERFORMANCE EVALUATION AND INTEGRATION OF ROUTING ALGORITHM IN SHUFFLE EXCHANGE WITH MINUS ONE STAGE

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NUR ARZILAWATI BINTI MD YUNUS

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

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

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Chairman: Professor Mohamed Othman, PhD Faculty:

Computer Science and Information Technology

Multistage interconnection networks offer an economical solution to communication and interconnection between system components. Optical Multistage Interconnection Networks (OMINs) are designed to provide an effective communication in switching. OMINs consist of stages that can route the switching through the path. OMINs with the Omega property considered as a practical connection to connect a large number of processors to establish multiprocessor system.

In this types of network the major problem occur when the switches failed to route in the stage, if these situations occur the switching need to route to an alternative path to avoid from system failure. Shuffle Exchange Networks (SENs) have been widely considered as practical interconnection systems due to their size of it switching elements (SEs) and uncomplicated configuration. It can helps in fault tolerance and reduce the latency. This research emphasize on the SENs architecture to derived estimation point of reliability value specifically for reliability performance in the interconnection networks.

The proposed Shuffle Exchange Network with Minus One Stage (SEN-) is design to increase the reliability performance in the interconnection networks. The SEN- is compared among others three SEN architecture known as Shuffle Exchange Network (SEN), Shuffle Exchange Network with Additional Stage (SEN+), and Shuffle Exchange Network with Two Additional Stages (SEN+2) to determine the highest reliability performance in SEN. There are three parameters used to measure the reliability performance on these four types of SENs namely terminal reliability, broadcast reliability and network reliability.

In addition this thesis also incorporates integration of routing algorithm to the SENs architecture. Several routing algorithm derived by past researches are also implemented for comparison purposed. These routing algorithms are Zero X, Zero Y, ZeroYbit, ZeroXbit, Sequential Increasing and Sequential Decreasing Algorithm. These six algorithms are integrated with four different types of SENs, and all the algorithms are analyze in this research. The results of this study show that the proposed SEN- increase the reliability performance approximately 39% as compared to other SENs architecture. The performance analysis showed that the integration of Sequential algorithm in SEN- architecture yield the better results in term of average number of passes and integration of ZeroX algorithm with SEN- yield a better results in term of execution time. For the conclusion it is prove in this research the proposed SEN- much more reliable than other SENs architecture. The SEN- gain the reliability performance in the interconnection network and also by integrate the SEN- in the routing algorithm it achieve the best performance among all the algorithms being tested in this research.

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

KEBOLEHPERCAYAAN PENILAIAN PRESTASI DAN INTEGRASI LALUAN ALGORITMA DALAM ROMBAKAN PERTUKARAN PENGURANGAN SATU FASA

Oleh

NUR ARZILAWATI MD YUNUS

Julai 2012

Pengerusi: Profesor Mohamed Othman, PhD

Fakulti: Sains Komputer dan Teknologi Maklumat

Rangkaian saling berhubung berbilang paras menawarkan penyelesaian ekonomi untuk komunikasi dan perhubungan di antara komponen sistem. Rangkaian saling berhubung berbilang paras optikal (OMINs) adalah reka bentuk untuk menyediakan komunikasi yang berkesan dalam pensuisan. OMINs terdiri daripada peringkat yang boleh memberi pensuisan laluan melalui jalan. OMINs dengan kelengkapan Omega dianggap sebagai sambungan praktikal untuk menyambung beberapa pemproses yang besar untuk mewujudkan sistem *multiprocessor*.

Dalam rangkaian jenis ini, masalah yang besar berlaku apabila suis gagal ke laluan di peringkat, jika situasi ini berlaku pensuisan perlu bertukar kepada laluan alternatif untuk mengelakkan daripada kegagalan sistem. Rombakan pertukaran rangkaian (SENs) telah secara meluas dianggap sebagai sistem rangkaian saling berhubung yang praktikal kerana saiz pensuisan elemen (SEs) dan konfigurasi yang tidak rumit. Ia boleh membantu dalam toleransi kesalahan dan mengurangkan kependaman Kajian ini memberi penekanan kepada seni bina SENs diperolehi dari titik anggaran nilai kebolehpercayaan khusus untuk prestasi kebolehpercayaan dalam rangkaian.

Pertukaran Rangkaian Shuffle dicadangkan dengan Pengurangan Satu Peringkat (SEN-) adalah reka bentuk untuk meningkatkan prestasi kebolehpercayaan dalam rangkaian antara sambungan. SEN-dibandingkan dengan tiga seni bina SENs yang dikenali sebagai Rombakan Pertukaran Rangkaian (SEN), Rombakan Pertukran Rangkaian dengan Peringkat tambahan (SEN+), dan Rombakan Pertukaran Rangkaian dengan Dua Peringkat tambahan (SEN+2) untuk menentukan kebolehpercayaan prestasi yang tertinggi dalam SEN. Terdapat tiga parameter yang digunakan untuk mengukur prestasi kebolehpercayaan ke atas keempat-empat jenis SENs iaitu kebolehpercayaan terminal, rangkaian dan penyiaran.

Di samping itu tesis ini juga menggabungkan integrasi laluan algoritma untuk seni bina SENs. Beberapa algoritma laluan yang diperolehi oleh kajian lalu juga dilaksanakan untuk tujuan perbandingan. Algoritma laluan ini adalah algoritma ZeroX, ZeroY, ZeroXbit, ZeroYbit, Turutan Peningkatan dan Turutan Pengurangan. Keenam-enam algoritma yang bersepadu dengan empat jenis SENs, dan semua algoritma dianalisis dalam penyelidikan ini. Keputusan kajian ini menunjukkan bahawa yang SEN- yang dicadangkan meningkatkan prestasi kebolehpercayaan kira-kira 39% berbanding seni bina SENs yang lain. Analisis prestasi menunjukkan bahawa integrasi algoritma Zero dan SEN- menghasilkan keputusan yang lebih baik dalam jangka bilangan purata pas dan integrasi algoritma ZeroX dan SEN- memberikan keputusan terbaik dalam masa pelaksanaan. Untuk kesimpulan, ia membuktikan dalam kajian ini SEN- yang dicadangkan lebih dipercayai daripada seni bina SENs yang lain. SEN- mendapat prestasi kebolehpercayaan dalam rangkaian antara sambungan dan juga dengan mengintegrasikan SEN- dalam algoritma laluan ia mencapai prestasi terbaik di kalangan semua algoritma yang diuji dalam kajian ini.

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I certify that an Examination Committee has met on date of viva to conduct the final examination of **Nur Arzilawati Md Yunus** on her Master of Science thesis entitled " Reliability Performance Evaluation and Integration of Routing Algorithm In Shuffle Exchange Network With Minus One Stage" in accordance with the Universities and Universities Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Azmi Jaafar, PhD
Associate Professor
Faculty of Computer Science and Information Technology
Universiti Putra Malaysia
(Chairman)

Shamala A/P K. Subramaniam, PhD
Associate Professor
Faculty of Computer Science and Information Technology
Universiti Putra Malaysia
(Internal Examiner)

Zuriati Ahmad Zulkarnain, PhD
Associate Professor
Faculty of Computer Science and Information Technology
Universiti Putra Malaysia
(Internal Examiner)

Rosni Abdullah, PhD
Professor
School of Computer Science
University Sains Malaysia
(External Examiner)

BUJANG KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. Members of the Supervisory Committee were as follows:

Mohamed Othman, PhD
Professor
Faculty of Computer Science and Information Technology
Universiti Putra Malaysia
(Chairman)

Zurina Hanapi, PhD
Lecturer
Faculty of Computer Science and Information Technology
Universiti Putra Malaysia
(Member)

BUJANG BIN KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I declare that the thesis is my original work 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 other institutions.

NUR ARZILAWATI BINTI MD YUNUS

Date :

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