

UNIVERSITI TEKNOLOGI MARA

**PARALLEL COMPUTING IN VIRTUAL
MACHINE: BEOWULF COMPUTER CLUSTER
USING VIRTUALBOX**

RUZALI BIN HUSSEIN

Thesis submitted in fulfillment of the requirements
for the degree of
Master of Science in Computer Networking

Faculty of Information Technology and Quantitative Science

May 2009

ABSTRACT

Parallel computing is preferable when dealing with advance computing problem such as in the area of aerospace, benchmarking, automotive, defenses, geophysics. The technology was exclusive for the riches, due to it was too expensive. Beowulf cluster computing was a break through for researchers, academicians and open source community as parallel computing is available for everyone. Using commodity hardware and free open sources software infrastructure it is sufficient to built a parallel computing system. However, the implementation of Beowulf Computer Cluster is still facing with complex configuration and setup. With virtualization, the complexity and time consuming of hardware implementation and setup can be reduced.

This paper presented comparison analysis between Beowulf Computer Cluster in virtual machine and a real Beowulf Computer Cluster. The result shows that virtual machine is able to adapt Beowulf cluster technology to provide a general purpose parallel computing environment on a single mini notebook.

ACKNOWLEDGEMENT

All praise to Allah S.W.T for giving me a good health, strength and patience to take this challenge and complete this thesis.

I would like to express my sincere gratitude to my supervisor Pn Siti Arpah Ahmad for his guidance, patience and encouragement throughout the study. Her valuable comments and suggestion were very helpful especially at the early stage of development phase of this thesis. I would also like to express my deepest gratitude to the lecturers at Faculty of Information Technology and Quantitative Sciences. Thank you for the knowledge shared.

Finally, I would to express my special thanks to my friends for their help and support. It has been a memorable experience, and it would not have been possible without the support and guidance from so many people who has made this a reality.

Terima Kasih

May Allah bless all of you.

TABLE OF CONTENT

	PAGE
ABSTRACT	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF FIGURES	viii
CHAPTER 1	
INTRODUCTION	
1.1 Introduction	1
1.2 Research Background	4
1.3 Statement of the Problem	5
1.4 Objectives	6
1.5 Scope and Limitation	6
1.6 Significance of the Study	7
1.7 Conclusion	8
CHAPTER 2	
LITERATURE REVIEW	
2.1 Introduction	9
2.2 Parallel Computing	11
2.3 Classes of parallel computers	13
2.3.1 Multi-core Computing	13
2.3.2 Symmetric Multiprocessing	13
2.3.3 Distributed Computing	14

2.4	Computer Cluster	15
2.4.1	High availability cluster	15
2.4.2	Load balancing cluster	15
2.4.3	Compute cluster	16
2.4.4	Grid computing	16
2.5	Beowulf Computer Cluster	17
2.6	Virtualization	19
2.6.1	Virtual Machine	19
2.6.2	Virtual Machine Software	21
2.7	Connectivity	21
2.7.1	Ifconfig	22
2.7.2	Ping	22
2.7.3	MPD Ring Test	22
2.7.4	CPI	23
2.8	Related Work	24
2.9	Conclusion	26

CHAPTER 3

METHODOLOGY

3.1	Introduction	27
3.2	Research Method	27
3.2.1	Planning Phase	28
3.2.2	Implementation Phase	31
3.2.3	Analysis Phase	37
3.2.4	Documentation Phase	37
3.3	Conclusion	38