UNIVERSITI TEKNOLOGI MARA

THE PROGRAMMING PRIMITIVES EFFECTS OF THE OVERLAPPING MESSAGE-PASSING AND COMPUTATION IN BEOWULF CLUSTER COMPUTING

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

Beowulf cluster computing is one of the parallel architectures that has been extensively utilized by exploiting the commodity aspect of its hardware and also the open codes of its software. It offers many advantages, but in order to support parallel and distributed applications, many factors of the cluster system have contributed to the performance bottleneck. One of these factors is due to the explicit primitives of its message-passing implementation. Basically, these primitives are divided into two types; blocking and non-blocking communications. For optimization purposes, the primitives can be applied to allow the overlap of the message-passing and computation to create an application with optimal completion time. However, the effects on the low-level issues concerning data overhead by using different primitives have not been explored in details. This research project empirically looks into the effect of the overlapping message-passing and computation in the proposed Beowulf cluster. It also develops new analytical tool to analyze the overlapping effect, particularly on the programming primitives characterizations. The scope of this research is based on the use of the Message Passing Interface (MPI) point-to-point communication on a collection of four computers that are connected to a switch via a network. Each computer is installed with Linux operating system and connected by UTP cables using Ethernet. The results demonstrate that increasing the message size for an overlap message transfer with computation will intensify the peak processing consumption. By adding more processors, the computing cluster provides higher packet transfer among the nodes. Nevertheless, the results demonstrate that as the message transfer is increasingly overlapped with computation, the TCP/IP overhead of the packet decreases. This outcome provides significant findings on the characterization of the primitives overhead in the Beowulf cluster system. The understanding of these primitive characterizations and their efficiency will provide programmers to use them selectively as they will eventually contribute to the improved performance of parallel applications.

TABLE OF CONTENTS