

Project Proposal

Introduction

Most computers do not fully utilize all the PCI card slots that are available on the motherboard. This under-utilization provides an opportunity for improvement. The goal of this project will be to investigate the potential of a coprocessor which would reside on a PCI card. This coprocessor could handle some of the workload of the main CPU. Envisioned is a PCI card with appropriate features to offer the computer more parallel processing power and more memory. Some specific research has already been explored regarding the use of graphics cards as specialized processing units. The goal of this project is to understand what obstacles face a general processing unit.

Objectives

The first part of this project is to survey the types of work done on the modern computer and determine what work could be efficiently done on a coprocessor. There are a lot of questions that need to be answered in analysis. What latency between the card and the system can be tolerated? Can multiple programs or only parts of a program run on the coprocessor? How should memory distribution be treated within the computer? Additionally the analysis will focus on what performance enhancements different classes of programs should experience when either running on a coprocessor or main processor. The analysis intends to provide as much a framework as possible for the project before a formal hypothesis is generated and a working prototype is made.

After this analysis, a detailed and specific hypothesis will be made in hopes of achieving increased performance within the computer. The hypothesis should explicitly state what the aspects of the card must be and should reflect the analysis done prior. The hypothesis will be detailed enough to specifically model the card either through simulation or a prototype.

The final aspect of this project will be to test the hypothesis. This will be carried out on either the prototype or simulation and should reveal whether the hypothesis worked out. If the original analysis was valid then the hypothesis should live up to the expected performance increase.

Motivation

The most basic motivation for doing this research is to determine whether the unused PCI slots in an average computer could be used for coprocessor cards. Furthermore this research will determine what class of applications will map well to running on coprocessor cards. This would increase the utilization of the computer and may drastically improve parallel processing. The need for parallel processing exists both in high performance computing and PC enthusiast computing. The general trend in computing is toward multiple cores which this may certainly contribute to.

Previous Work

Previous work has already been done in this area to the extent that many researchers have developed clever methods of unloading specific computation from the main processor to the graphics processor. Further work has considered treating this graphics processor as a general processor but has found the processor too specialized. This research will specifically consider the benefits of a general processor that is not specialized for graphics processing.