

## Introduction

In addition to the regular class work, a small research project is required for BS/MS credit for this course. You may select from the following two projects, or you may propose your own project. The two projects are:—

- Accumulate a list and description of current research projects aimed at software approaches for programming computers with 100-1000 processor cores per chip.
- Prepare a teaching topic about processors for smart phones.

Your project is due at the start of the last class, March 1, 2011. You may submit an outline of your findings for preliminary review and comment two weeks prior to the last class.

## Project Statement #1 — 100-1000 Cores

In the first class of this term, the Professor, speaking directly from David Patterson's notes, asserted that (a) the number of processor cores per processor chip will double every two years, (b) Intel has an 80-core chip currently in active development, and (c) a “sea change” is required in the way the industry approaches software development for multi-core processor chips. (See lecture notes *What is Computer Architecture?* from the first week of term.)

In this project, you must conduct a literature and web search of research projects that are devoted to making this sea change. That is, you must find and identify research projects being carried out for the purpose of finding ways to effectively program systems with large numbers of cores (100-1000 or more per chip) and who is carrying out that research. For each major research effort you find, you should summarize what general approach that team is taking, what their hypotheses are, and what they hope to prove.

### *Final Report*

The product of this project should be a well-presented technical report of about ten pages in length, including bibliography. As with any literature study, your report should synthesize what you learned, and not merely be a concatenation of reviews of individual papers. Also, as with any literature study, you are responsible for validating your sources.

Note that while *Wikipedia* is a very useful tool for helping you to find things on the Internet, it is *not* valid citation in a bibliography. You need to work backwards from what you find in Wikipedia until you get to original or other authoritative sources, and then you should cite those. The emphasis should be *breadth*; that is, you do not have to master all of the technical details of every research paper you find.

## Project Statement #2 — Smart Phone processors

Appendix J of Hennessy and Patterson's textbook gives an overview of a number of RISC architectures, including the ARM and Thumb, which are widely used in embedded systems and smart phones. Study this chapter, and then research the characteristics of smart phone oper-

ating systems and applications that make these (or other) processors particularly appropriate, as opposed to traditional MIPS, SPARC, Pentium, etc. Focus both on the nature of the applications and the nature of the usage of smart phones that cause their processor requirements to be different from the requirements of other kinds of applications. You may use research papers, industry white papers, and other material from the technical literature and the web. You should, however, avoid marketing hype. As noted above, *Wikipedia* is not a suitable reference source, but it may be used to lead to one.

### ***Final Product***

The final product of this project should be a set of PowerPoint slides and speakers notes for a one-hour (i.e., 60-minute) class lecture on the subject of processors for smart phones. Be sure to include block diagrams of a processor architecture, pipeline, and whatever features are used to obtain processor performance. Highlight areas that are significantly and/or substantively different from processors for desktops, laptops, or servers, particularly with respect to power management, caching, etc.