

CS99S The Coming Revolution in Computer Architecture

Location: Gates 392
Time: Monday and Wednesday 9:15 to 10:45AM

Instructor: Bill Dally
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Hours: Monday and Wednesday 11-12AM

TA: John Owens
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Hours: Monday 4-5:45PM

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Course Overview

For the past 30 years, microprocessor performance has increased at a rate of about 50 percent per year, a factor of 60 per decade, while maintaining the same basic programming model and architecture. Over the next decade, the performance of classical architectures will increase at a much lower rate, about 20 percent. Staying on the historical performance curve will require new architectures that exploit the characteristics of emerging technology. This performance differential will motivate a revolution in computer architecture in which the architecture that has reigned for the last 50 years will be replaced by one or more radically new ones. This seminar will look at the coming revolution in computer architecture. We will start by examining the classic architecture, the technology trends that have driven its performance growth, and the factors that are leading to the end of this growth. Next, we will examine characteristics of technology that can be exploited for future growth. Application areas will also be discussed. Finally, we will explore some alternative organizations and programming systems that may replace the status quo.

Goals

The primary goal of the class is to teach you to think about an unconstrained technical problem. We will do this in the context of computer architecture. A secondary goal is to teach you the basics of computer architecture and to introduce you to many of the major ideas in the field.

Approach

The class involves reading book chapters, articles, and papers on relevant topics, discussing these papers during class meetings, and a number of hands-on projects to introduce you to the nuts and bolts of computer hardware.

Assignments

Reading: before each class meeting you are expected to complete the assigned reading. No later than 5PM the day before the meeting you should e-mail the instructor and TA three discussion questions about the reading.

Weekly Papers: each week you will be writing a short paper on an assigned topic. Papers should be no longer than two pages – 12-point font, double-spaced. The instructor will review your paper and give you feedback within 48 hours of the due date.

Final Paper: you will write a final paper describing your vision of a 2011 computing device. This final paper can be up to 15 pages (12point double-spaced). There will be no weekly paper assignments during the last three weeks of the term to give you time to work on this final paper.

Lab preparation: before many of the practical laboratories, some preparation work will be assigned.

Labs

Each class period will devote about 30min to a hands-on exploration of computer technology. We will start by building gates from transistors and basic logic circuits from gates, working our way up to simple finite-state machines. We will then spend some time examining integrated circuit design. The goal of the labs is to put some reality behind many of the more abstract concepts we will discuss in class.

Grading

Your final grade will be assigned according to the following weights:

Class Participation	25%
Weekly Papers	40%
Final Paper	35%

Email

If you have questions concerning the class or related material, please do not hesitate to email the instructor or the TA. We will make every effort to respond to legitimate email questions within 24 hours.

Dinner

To provide an atmosphere for more informal discussion we would like to have dinner in the dorms with the class once per week. Please sign up to host this dinner one week. There will also be a barbec e at the instructor's house on October 14th – details to follow.

Collaboration Policy

You are encouraged to discuss the class material and paper assignments with your classmates. However, your written papers must be your own work, and if you use someone else's idea in a paper (either a classmate's or an outside source) you must acknowledge that person.