Course Syllabus of 16.650 Advanced Computing Systems Hardware Architecture (Spring 2007)

Table of contents

1. Basic Information

This course covers interesting topics of computer architecture such as pipelining, instruction level parallelism, memory hierarchy, VLIW, multithreading etc. The course intends to give a picture on recent technology trends and state-of-art platforms such as chip-multiprocessor, network processor and FPGAs. Case studies such as Google search engine and Playstation are also to be covered. The format of the class is lecture and projects. Students will work on a project towards the end of the course. We have interesting projects available. For example, students can work on design and implementation of network processor based packet inspection or FPGA-based content processing systems. The projects can lead to operational prototype systems and/or publishable papers. Most importantly, experiences from the projects will benefit the student in future job search and career development.

Instructor: Prof. Yan Luo

Office Hours: WF 9:30am-11am

Office Location: Ball 413

Phone: (978) 934-2592

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Class time: M 6:30pm-8:50pm

Class location: TBA

2. Course structure

There is 2.5 hours class on Monday each week. The class will be in the format of lecture and project. Students will be assigned readings and present papers in classs.

3. Textbook

John L. Hennessy and David A. Patterson, "Computer Architecture: A Quantitative Approach," 4th Edition. Morgan Kaufmann Publishers, 2006. ISBN-10: 0123704901, ISBN-13: 978-0123704900

Additional technical papers are to be assigned.

4. Topics to Be Covered

The following topics will be covered by the instructor's lectures.

- Pipelining and hazards - Appendix A
- Instruction level parallelism, dynamic exploitation – Ch 3
- ILP with software approaches – Ch 4
- Memory hierarchy – Ch 5
- VLIW, multithreading, CMP and network processor architectures – From papers
- Case studies: Google cluster, Playstation etc.

5. Projects

Students need to discuss the instructor about topics of projects or term papers. Possible topics are as follows.

1. Regular Expression Matching with FPGAs:
2. NePSim2: Network Processor Simulator and Benchmarking
3. Performance Evaluation of Chip Multiprocessors:
4. Wireless Sensor Networks for Health Care Applications:
5. PCI-based Content Processing Accelerator

6. Reading List

To be posted.

7. Service Learning

Students in this course participate in <u>Service-Learning of the College of Engineering</u>. Some of the projects are oriented to find effective solutions to the real-world problems for the community.

8. Course Grade

The distribution of tests, class participation and projects are given below.

Components	Percentage
Test One	15%
Test Two	15%
Class Participation	20%
Project	50%
Total	100%

A minimum standard of 60% in the combined experiment, homework and examination grades is used as a measure for the passing of the course. Assignments of course (letter) grades other than "F" depend on class distributions, which usually start with a minimum of 90% for "A".

9. Course Schedule

Course schedule is HERE.

10. Selected Student Projects

All the students in our Spring 06 semester did great jobs in their course projects. The following are two selected project reports.

- Hayes and Singhal, Rules-based Network Intrusion Detection using a Field Programmable Gate Array, Final Report
  PDF
- Weinberg and Zhang, Wireless Sensor Network for Temperature Monitoring, Final Report
  PDF