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TA Office Hours: MWF 9:00-10:30am

Course home page will be on Canvas (go to courses.utexas.edu)

Course Description: Evaluating computer architectures have become extremely difficult due to the complexity of the systems/processors and the complexity of the applications that run on the computers. This course will focus on techniques to evaluate performance and power/energy consumption of microprocessors and computer systems. Course notes and several papers from the computer architecture, performance evaluation and workload characterization related conferences will be used as course material.

Prerequisites:

EE 360N/460N/382N.1 - Computer architecture. If you did not take this course at UT, please see me with info on the course you took (book, assignments, exams)

Good programming skills (C and Unix) and at least one assembly language

Text Book:

No required text book, but I’ll use material from several sources including

Performance Evaluation and Benchmarking, Edited by Lizy John and Lieven Eeckhout, CRC Press, Taylor & Francis, (Optional)


A Collection of Papers from conferences and journals. Will provide list on course web page

Other References:

Computer Organization and Design, Patterson and Hennessy

Computer Architecture: A Quantitative Approach, Hennessey & Patterson

ISCA, HPCA, Micro, ASPLOS, IISWC and ISPASS Proceedings.
Grading Policy:

HW Assignments, Paper Critiques, Lit Survey, Class Participation 30%
Test1 20%
Test2 20%
Project and Project Presentation 30%

A = 92%, A- = 89%, B+= 85%, B=80%, B- = 78%, C= 70%, D=60%, F= Below 60%

HW assignments will include some paper and pencil assignments, some programming assignments, paper reading/critiquing, etc. Class participation will include participating in paper discussions, discussion leading when it is your turn, being on-time to class, etc

Course contents:

- Issues in Evaluating Performance and Power/Energy of Computers
- Measurement Tools and techniques, Trace Driven and Execution Driven Simulation
- Benchmarks, CPU-intensive, Commercial and database, web server
- Workload Characterization (Quantitative and Analytical)
- Characterization of Emerging Applications
- Statistical techniques for Performance Evaluation
- Trace Generation and Validation, Synthetic Traces, Verification of Simulators
- Design of Experiments
- Analytical Modeling of Processors, Statistical modeling, Hybrid Techniques- Application of queuing theory, Markov models and probabilistic models for computer system evaluation

Course Evaluation: There will be a formal course evaluation towards the end of the semester. I will also be doing several informal intermediate evaluations. I am interested in tailoring the course to result in maximum benefit for you. Please feel free to offer comments.

Academic Dishonesty: Faculty in the ECE Department are committed to detecting and responding to all instances of scholastic dishonesty and will pursue cases of scholastic dishonesty in accordance with university policy. All parties in our community -- faculty, staff, and students -- are responsible for creating an environment that educates outstanding engineers, and this goal entails excellence in technical skills, self-giving citizenry, and ethical integrity. Industry wants engineers who are competent and fully trustworthy, and both qualities must be developed day by day throughout an entire lifetime. Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, falsifying academic records, or any act designed to give an unfair academic advantage to the student. Penalties for scholastic dishonesty are severe and can include, but are not limited to a record in your academic folder, a zero on the assignment/exam, re-taking the exam in question, an F in the course, or expulsion from the University. Don’t jeopardize your career by an act of scholastic dishonesty. You can find UT Honor Code at http://registrar.utexas.edu/catalogs/gi09-10/ch01/index.html.

Drop Policy: An engineering student must have the Dean’s approval to add or drop a course after the fourth class day of the semester. Adds and drops are not approved after the fourth class day except for good cause. “Good cause” is interpreted to be documented evidence of an extenuating nonacademic circumstance (such as health or personal problems) that did not exist on or before the fourth class day. Applications for approval to drop a course after the fourth class day should be made in the Office of Student Affairs, Ernest Cockrell, Jr. Hall 2.200
Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259, http://www.utexas.edu/diversity/ddce/ssd/.

By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.
EE 382M  More Info on Grading

Paper and Pencil HW Assignments + Programming assignments (Approx 500 pts)

News presentation – Each student should present an interesting news item on a modern processor with 1-2 slides to class (no more than 2 mnts + 3 mnt discussion) (40 pts)

Paper Critiques, Questions based on papers – read paper and write critique before the class the paper is being discussed (10 pts per writeup = approx 150 pts)

Scribing – One student takes notes during lecture, refines it and uploads it for everybody within 36 hours after class. (40 pts each time)

Class Participation – 5 pts each time.
   Be on-time
   Participate in discussions
   No Disruptive behavior
   If you are late you lose some points. 2 of those grades will be dropped. (20 * 5 = 100). If you are absent, you get 0.

Literature Survey – 50 pts

All of the above – expect it to be approximately 900 pts. And that will constitute 30% of the course grade.

Preliminary project Interest Document (to help find matching partners) - Sep 13

Literature Survey - Sep 27

Project proposal due - Oct 2

Project Interim Report 1 - Nov 1
Project Interim Report 2 - Nov 25

Project Presentations – Dec 1 and 3

Test 1 (20%) - October 9
Test 2 (20%) - Nov 20
Literature Survey and Project Proposal

Suggested group size: 2 students (if a project justifies another group size, talk to me and we can decide based on the specific scenario)

There are several types of projects:
• Workload Characterization on Desktops/Servers
• Workload Characterization on Embedded Systems (Java enabled boards, mobile systems)
• Experiments with Emerging Workloads (Workload/Benchmark Characterization)
• Improving Speed of Simulation by Simpoint, Sampling, etc.
• Power Measurements/Simulation
• Analytical Models
• Create a new Cloud benchmark
• Benchmark Similarity Studies

Reproducing results from a published paper from IISWC, ISPASS, ISCA, ASPLOS, HPCA, or MICRO will be acceptable as a project. If you make an extension to what has been published, that will be excellent.

The project proposal should address
  Objectives - What are you trying to find out? What’s the problem you are trying to solve? What is the interesting question you are trying to answer?
  Background and Motivation - What have others done in this area? Why do you think it is important to do more work? What is the significance of this work? It is important to relate what you are doing to what others have done before.
  Research Plan - How you plan to do it? Any existing simulators or tools or are you planning to build your own tools? If developing a simulator, the level of the details. What experiments do you plan to perform?
  Expected Outcome - The results of the project. What would be the outcome from the project once it is completed.
  Significance or impact of the work/study

Literature Survey and Project Proposal - 5 to 10 pages (Single spaced IEEE format)
This survey is your preliminary reading to identify a suitable project. You choose an area of interest and read 3-10 papers in that area. Must contain summary of at least 3 non-www references. ISCA, Micro, HPCA, ASPLOS, ISPASS, IISWC, PACT, IEEE-TC are all potential sources of references. You may use white papers or www sources as additional references. If you are not finding enough references talk to me early in the semester, way before the project proposal is due.

Project Proposal (2-3 pages) – 2.5% of course grade
Interim Reports (1-3 pages) – 2.5% of course grade (1% and 1.5%)
Project Presentation – 5% of course grade
Final Project report – 20% of course grade
**Suggested Project Topics:**

Performance/Power Characterization of Cloud Workloads/Benchmarks (eg: BigDataBench, CloudSuite)

Performance/Power Characterization of Virtualization Workloads/Benchmarks(eg: SPEC Virt)

Performance/Power Characterization of Analytics Workloads/Benchmarks (eg: Graph 500, TPCH)

Performance/Power Characterization of Embedded Workloads/Benchmarks (Android phone apps, tablet apps, sensor networks)

Performance/Power Characterization of Web Server Workloads/Benchmarks

Performance/Power Characterization of GPGPU workloads

Performance/Power Characterization of Java benchmark suites’

Synthetic proxies for supercomputing applications and comparison against miniapps, dwarves, etc.

A synthetic proxy benchmark for Java applications

A synthetic proxy benchmark for database applications

A synthetic proxy for GPGPU applications

Synthetic Proxy for Cloud (Hadoop Perf Eval without Hadoop)

A power virus (max power benchmark) for GPGPU

Do an FFT or MATMUL accelerator on a system like the Convey and compare performance of a pure software implementation against the accelerated version

Similarity/Dissimilarity of XXX workloads (within XXX suite, how similar are the benchmarks) (or, how similar is XXX suite with YYY suite)

Similarity/Dissimilarity of HINT and CPU 2006

If you are interested in any of the above projects, I can suggest some papers for literature survey.

**Past Class Projects that became Papers:**


TENTATIVE READING LIST:
(The first half of the papers in this list are likely to be used in class this semester, but I have used many of the papers from the second half in some years. The second half are also papers you can try to read for Literature survey and project ideas.)


21. Hadi Esmaeilzadeh, Emily Blem, Renée St. Amant, Karthikeyan Sankaralingam, Doug Burger, Dark Silicon and the End of Multicore Scaling, ISCA 2011

22. Lim, K.; Univ. of Michigan, Ann Arbor, MI; Ranganathan, P.; Jichuan Chang; Patel, C. Mudge, T.; Reinhardt, S., Understanding and Designing New Server Architectures for Emerging Warehouse-Computing Environments, ISCA 2008

23. Tony Nowatzki, Jaikrishnan Menon, Chen-Han Ho, Karthikeyan Sankaralingam, gem5, GPGPUSim, McPAT, GPUWattch, "Your favorite simulator here" Considered Harmful, WDDD Workshop


25. Bhandarkar, D and Clark D.W., Performance from architecture: comparing a RISC and a CISC with similar hardware organization, ASPLOS 91


29. SMARTS: Accelerating Microarchitecture Simulation via Rigorous Statistical Sampling, ISCA 03,


