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Fall 2012

CEG 7350-01: Computer Architecture

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CEG 7350 Computer Architecture

Fall Quarter, 2012

Description: Review of sequential computer architecture and study of parallel computers. Topics include memory hierarchy, reduced instruction set computer, pipeline processing, multiprocessing, various parallel computers, and interconnection networks.

Prerequisite: CEG 6350 Operating Systems Internals and Design, or equivalent

Prerequisite Topics: Process management, CPU scheduling, and Memory management.

Instructor: Dr. Soon M. Chung, 403 Russ Engineering Center (937-775-5119)
soon.chung@wright.edu, <http://www.cs.wright.edu/~schung>

Class: M. W. 6:10-7:30 pm at 155 Russ Center.

Office hour: M. W. 4:45-5:45 pm at 403 Russ, or by appointment.

*use e-mail for short questions.

Text Book:

- J. L. Hennessy and D. A. Patterson, Computer Architecture, 5th edition, Morgan Kaufmann, 2011.

References:

- K. Hwang, Advanced Computer Architecture: Parallelism, Scalability, and Programmability, McGraw-Hill, 1993.
- A. Silberschatz, P. Galvin, and G. Gagne, Operating System Concepts.

Topics:

Review of OS Concepts

Overview of Computer architecture and Parallel Processing
Processors
Memory Hierarchy Design
Main Memory Management
Memory Interleaving and Access
Cache Memory Management and Multicache Coherence
Interconnection Systems
Redundant Array of Inexpensive Disks (RAID)
Message-passing Architecture and Routing Mechanism
Realtime Systems
Fundamentals of Quantitative Design and Analysis
Instruction Level Parallelism and Its Exploitation
Data Level Parallelism in Different Architectures

Grading: A:[85,100], B:[75,85), C:[65,75), D:[55,65), F:[0,55)

- Midterm 30% (10/17, W.), Project 30%, Final 40% (12/12, W., 5:45-7:45 pm)

- Project is paper-review or design/implementation. Select one by 10/17.
- The final report is due on the last class, 12/12.
 - (1) Paper-review project {papers reviewed 7%, technical quality 8%, presentation 6%, discussion 9%}
 - (2) Design/implementation project 30% {originality 7%, technical quality 8%, presentation 6%, discussion 9%}

CEG 7350 Paper-Review Project

1. Choose a topic and select at least 5 relevant technical papers. High-quality journal papers are preferred.
2. Summarize and compare the papers, and then add your own discussion.
3. Submit the working title and the list of candidate papers. (due 10/17)
4. Present in the class, and submit the report and the papers you studied. (due 12/12)
5. Size of the report is around 30 pages in double-space.
6. This project can be done as an individual project or a team (of two) project.

Possible Topics

- Multiprocessor cache management
- Multicore processors
- SIMD, MIMD machines
- Fault tolerant computing
- Parallel algorithms
- Performance evaluation of parallel computers
- Interconnection networks
- Cluster computing
- GRID and Cloud computing
- RISC/CISC processors
- Reconfigurable array of processors
- Optical computing
- Application specific architectures
- Realtime computer systems
- Artificial neural network
- Other relevant topics

Reference Sources

- IEEE Transactions on Computer
- Computer (IEEE Computer Magazine)
- Communications of ACM
- IEEE Tutorials, such as Tutorial on computer architecture, on supercomputing, etc.
- Proceedings of Int'l Conf. on Parallel Processing
- Proceedings of Int'l Symposium on Computer Architecture: available in the volumes of Computer Architecture News
- Journal of Parallel and Distributed Computing
- ACM Transactions on Computer Systems
- IEEE Transactions on Parallel and Distributed Systems
- ACM Computing Surveys
- ACM/Springer Multimedia Systems
- IEEE Multimedia
- ACM Transactions on Modeling and Simulation
- IEEE Transactions on Knowledge and Data Engineering
- IEEE Transactions on VLSI
- IEEE Transactions on Neural Networks
- IEEE Micro
- Journal of Supercomputing
- and others

CEG 7350 Design/Implementation Project

1. Do either (A) or (B):
 - (A) Design, implementation, and/or performance analysis (i.e., deterministic modeling, analytical modeling, or simulation) of a computer system component.
 - (B) Design a parallel algorithm or implement an existing parallel algorithm using MPI (Message Passing Interface) or Java RMI.
2. Submit a description of your topic and a list of reference documents (if any). (due 10/17)
3. Present in the class and submit the report (report due: 12/12)
4. Size of the report is between around 20 pages in double-space.
5. This project can be done as an individual project or a team (of two) project.

Possible Topics

- Memory/cache management in multiprocessor system.
- MIMD machines
- Fault tolerant computing
- Parallel algorithms for numeric or nonnumeric computation.
- Performance evaluation of parallel computers
- Interconnection networks
- Dataflow machines
- Systolic array
- Optical computing
- Application-specific architectures, such as database machines, Image processing machine, etc.
- Artificial neural networks
- RAID (Redundant Array of Inexpensive Disks)
- Multicore Processors
- Multimedia Systems
- Cluster computing
- Grid computing
- Other relevant topics

Reference Sources

- IEEE Trans. on Computer
- Computer (IEEE Computer Magazine)
- Communications of ACM
- IEEE Tutorials, such as Tutorial on computer architecture, on supercomputing, etc.
- Proc. of Int'l Conf. on Parallel Processing
- Proc. of Int'l Symposium on Computer Architecture: available in the volumes of Computer Architecture News
- Journal of Parallel and Distributed Computing
- ACM Trans. on Computer Systems
- IEEE Trans. on Parallel and Distributed Systems
- ACM Computing Surveys
- IEEE Trans. on Knowledge and Data Engineering
- IEEE Trans. on Neural Networks
- IEEE Micro
- ACM/Springer Multimedia Systems
- IEEE Multimedia
- and Others