This graduate level computer architecture course takes a broad view and emphasizes gaining insights and mastering foundational principles. Its primary objective is to prepare students to be highly skilled designers, implementers, and innovators of advanced processors and computer systems in the industry. Special focus is placed on superscalar and multi-core designs, and performance, power, and energy optimizations. We plan to invite several CMU alums who are currently practicing architects in the industry to give several guest lectures.

**Lectures (tentative, 11/16/2013)**

- **Tuesday, January 14, 2014**
  Lecture 1: Introduction to Computer Architecture

- **Thursday, January 16, 2014**
  Lecture 2: Software and Technology Interplay

- **Tuesday, January 21, 2014**
  Lecture 3: Pipelined Processor Analysis (Review and refresh)

- **Thursday, January 23, 2014**
  Lecture 4: From Pipelining to Superscalar (Why go superscalar)

- **Tuesday, January 28, 2014**
  Lecture 5: Superscalar Processor Organization

- **Thursday, January 30, 2014**
  Lecture 6: Instruction Flow Techniques

- **Tuesday, February 4, 2014**
  Lecture 7: Branch Prediction (Bagful of Tricks)

- **Thursday, February 6, 2014**
  Lecture 8: Register Data Flow Techniques

- **Tuesday, February 11, 2014**
  Lecture 9: Dynamic Scheduling (OOO Execution)

- **Thursday, February 13, 2014**
  Lecture 10: Memory Data Flow Techniques

- **Tuesday, February 18, 2014**
  Guest Lecture: “Pentium Pro Case Study” (The most profitable microarchitecture)

- **Thursday, February 20, 2014**
  Review for Exam I

- **Tuesday, February 25, 2014**
  Exam I

- **Thursday, February 27, 2014**
  Guest Lecture: “Four Decades of Computer Architecture” (tentative)

- **Tuesday, March 4, 2014**
  Lecture 11: VLIW Architecture (Sequel of the RISC vs. CISC debate)

- **Thursday, March 6, 2014**
  Lecture 12: Dynamic Binary Translation (ISA really doesn’t matter)
- Tuesday, March 11, 2014
  Spring Break Recess (no lecture)
- Thursday, March 13, 2014
  Spring Break Recess (no lecture)
- Tuesday, March 18, 2014
  Lecture 13: Multithreading Execution (From ILP to TLP)
- Thursday, March 20, 2014
  Lecture 14: Multi-Core Architecture (Current rage in mobile space)
- Tuesday, March 25, 2014
  Lecture 15: Multi-Core Cache Coherence
- Thursday, March 27, 2014
  Lecture 16: Performance and Power Iron Laws (The science part)
- Tuesday, April 1, 2014
  Lecture 17: Vector and Graphics Processors (Data level parallelism)
- Thursday, April 3, 2014
  Lecture 18: Low Power Processor and Energy Efficiency (The major challenge)
- Tuesday, April 8, 2014
  Lecture 19: Mobile Cloud Computing Trends (Some personal speculations)
- Thursday, April 10, 2014
  Spring Carnival Prep (no lecture)
- Tuesday, April 15, 2014
  Guest Lecture: “Snap Dragon Multi-Core SOC Overview” (tentative)
- Thursday, April 17, 2014
  Lecture 20: Memory Technology and Integration (Amazing changes taking place)
- Tuesday, April 22, 2014
  Guest Lecture: “3D TSV Die Stacking in the Industry” (tentative)
- Thursday, April 24, 2014
  Review for Exam II
- Tuesday, April 29, 2014
  Exam II
- Thursday, May 1, 2014
  Course Wrap Up

**Instructor:** John P. Shen  Adjunct Professor, ECE Department, CMU (jpshen@cmu.edu)

Prof. Shen is currently a Nokia Fellow and was the founding director of Nokia Research Center - North America Lab with teams pursuing research in mobility and mobile computing. Prior to joining Nokia he was the Director of the Microarchitecture Research Lab at Intel. Prior to joining Intel he was a tenured Full Professor in the Electrical and Computer Engineering Department at Carnegie Mellon University, where he supervised a total of 17 PhD students and dozens of MS students, received multiple teaching awards, and published two books and more than 100 research papers. One of his books, “Modern Processor Design: Fundamentals of Superscalar Processors” (McGraw-Hill 2005) is still being used in the EE382A Advanced Processor Architecture course at Stanford University. He has been a guest lecturer at Stanford and CMU-SV.