

CMPE110 Lecture 01

Introduction

Heiner Litz



A Few Words About Heiner

Asst. Professor of CSE

Postdoc Stanford University

Ph.D. from Heidelberg University

Current research

Data Center Computing

Storage Systems

ML for Computer Architecture

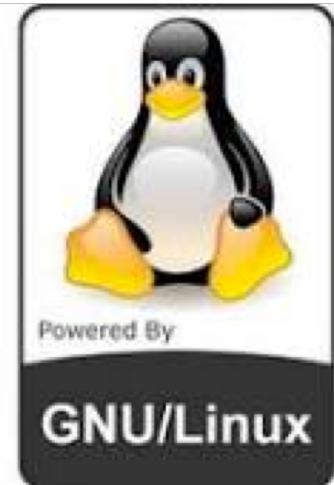
More details at

<https://people.ucsc.edu/~hlitz/>

EXTOLL HPC



Kernel Developer



Openchannel SSD



The CMPE110 Team



Instructor

Heiner Litz

Teaching assistants

Peter Braun

Saba Jamilan

Minghao Xie

Readers

Pete, Vien, Matthew, Kartik



What is CMPE110 About?

Focus

How to architect programmable digital systems

Introduction to processor, memory, and I/O system design

How to improve the efficiency digital systems

Key techniques for performance, power, and cost optimizations (HW & SW)

Motivation

Efficiency improvements are the key force in the IT industry

For ~30 years, we got +50% performance every year at constant power

But semiconductor efficiency scaling has now stopped

All computers are now energy constrained (cellphones → datacenters)

To get more from them, we must improve their efficiency

You can't write efficient software unless understand hardware

This is why Apple, Google, and Microsoft co-develop HW & SW

CMPE110 Topics



Hardware-software interface

Key abstractions for programmable hardware

Including data-level and thread-level parallelism

Efficiency metrics

How to reason about performance, power/energy, and cost

Programmable and custom hardware design

Memory system design

For simple and multi-core or heterogeneous systems

Operating system support

Virtual memory

I/O devices and interfacing techniques

Syllabus & Course Information



Please see first handout on webpage

Includes: staff contact info, tentative schedule, policies, ...

Contact class staff with any questions

Assignment and exam dates are listed

Make sure you have time for everything

If not, you should not take CMPE110

Lectures & Discussion Sessions



Lectures

Mo & Wed & Fri, 1:20– 2:25pm, Earth & Marine B206

Review sessions

See Canvas website

You should actively participate in lectures

Feel free to interrupt for Q&A and further thoughts on material

Share experience from other classes, projects, jobs, internships

This is your way of setting the pace & quality of the class

DRC Accommodations



- 1. Students contact the DRC to determine their eligibility for accommodations in the **first 3 weeks of the quarter**. When approved by DRC, they will receive their Accommodation Authorization form.
- 2. Students then notify their instructor during office hours or after class of their accommodations, and provide their instructor with their Accommodation Authorization form (**physically printed forms**).
- 3. Please note that it is the student's responsibility to contact the instructor about their accommodations. If they do not contact their instructor, accommodations will not be made.

Prerequisites



- CMPE 12 and
- CMPE 13 or CMPS 12A

- Skills
 - Linux (shell)
 - C/C++
 - GCC/Make

Other Course Info



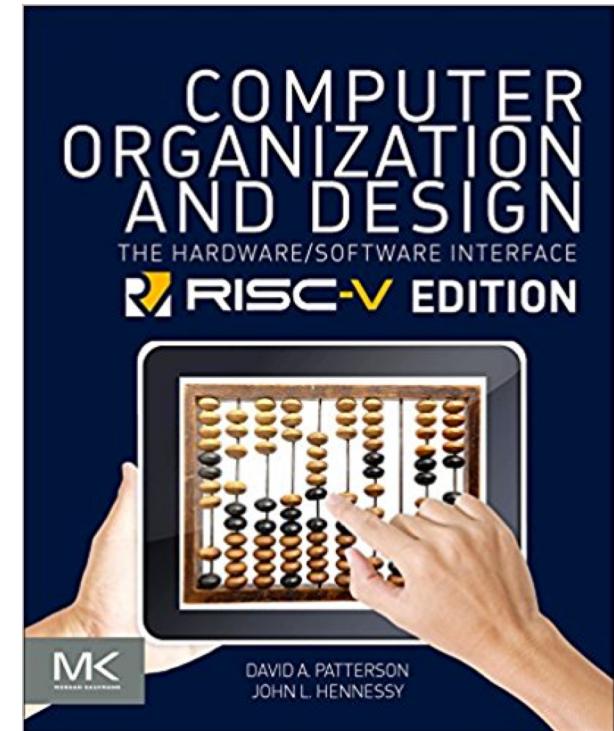
Textbook

Computer Organization & Design, 5th Edition

By David Patterson & John Hennessy

Get one – it is a great book

(Also try to Google for it)



Website

<https://canvas.ucsc.edu/courses/19290>

Check frequently

Handouts

Everything available online

Q&A on Piazza



The preferred way to ask class-related questions

We promise to check & answer very often, especially close to deadlines

All registered students will be invited to class page on piazza

The rules

Before posting a new question, check if it's already been asked

Use the **search** function of Piazza

Choose an appropriate subject for your question

E.g. "HW2, problem 3, definition of memory latency"

My Linux/GCC/Perf is not working!

We don't do SW support – use Google, Stackoverflow

Questions asking for a HA solution will not get an answer (but maybe a hint)

For questions not appropriate for the public: send us an email

We do encourage critical feedback

The earlier you tell us the more likely we'll address it



Workload

5-6 homework sets

Work in groups of 3 (exactly)

Submit electronically via Canvas

6-8 quizzes

2 exams

Midterm and final exam

No late days

Exams



Midterm: Wednesday February 13th

Room & time: In class

Final: Thursday, March 21

4:00pm – 7:00pm, classroom E&M B206

The rules

Closed books, 1 page of notes, calculator

Alternative time available for legitimate conflicts

If you have a disability contact OAE asap

Tentative Grading



Homework sets	10%
Quizzes	10%
Midterm	20%
Final	60%



Academic Misconduct (cheating)

- Sanctions:

https://www.ue.ucsc.edu/academic_misconduct

- C. Architecture is Important and Exciting
- Your skills >> GPAs
- Be fair to your cohort (150+ waiting list)

Credits



Lecture slides have been adapted from

- Christos Kozyrakis
- Jose Renau
- Jishen Zhao
- Ethan Miller

Introduction to Computer Architecture

Heiner Litz

<https://canvas.ucsc.edu/courses/12652>

Announcements



- Check out Canvas website

- No review sections this week

Computer Architecture



Narrow view: a computer



Computer Architecture



Actually, most look like this...



What's Inside a Digital System?

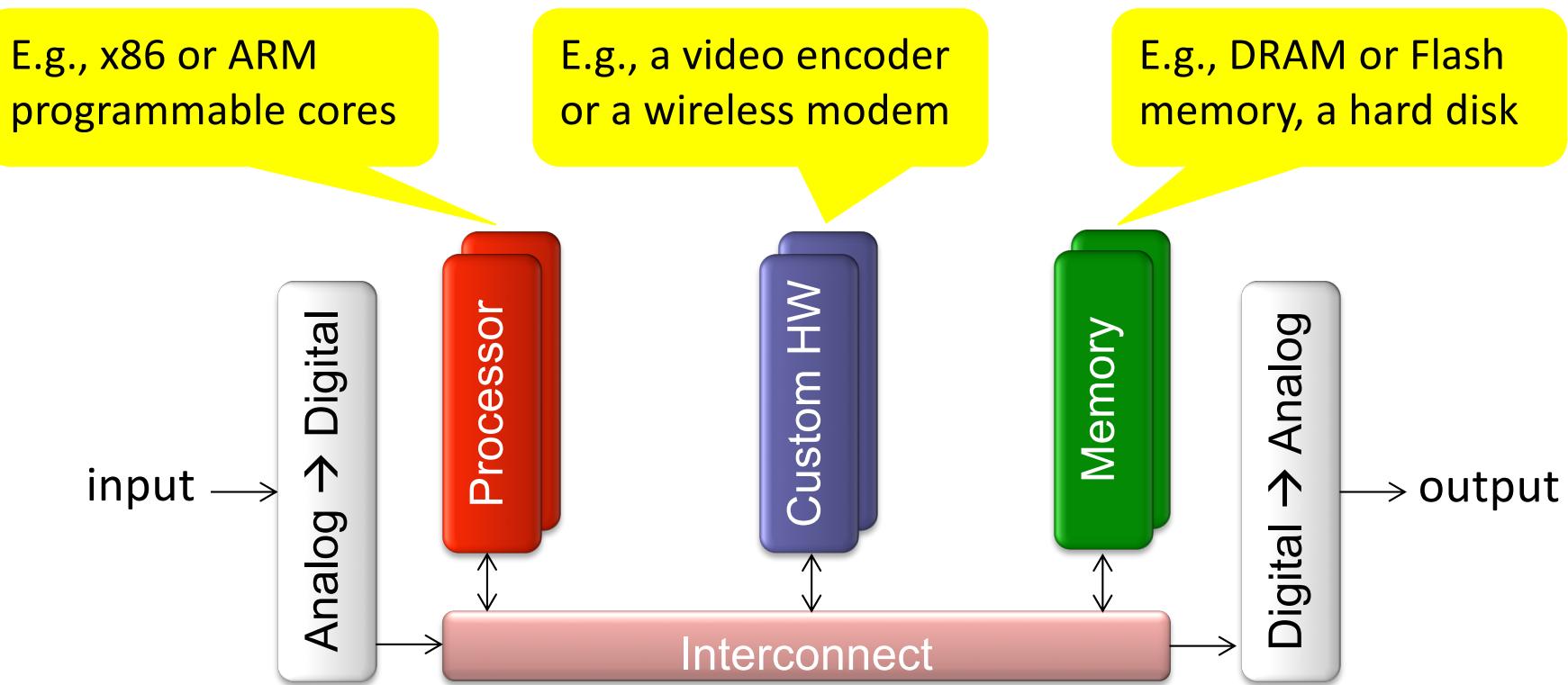


Have you opened up a computer or phone?

What puzzles most about how they work?

Why your cellphone runs out of battery quickly?

Inside a Typical System



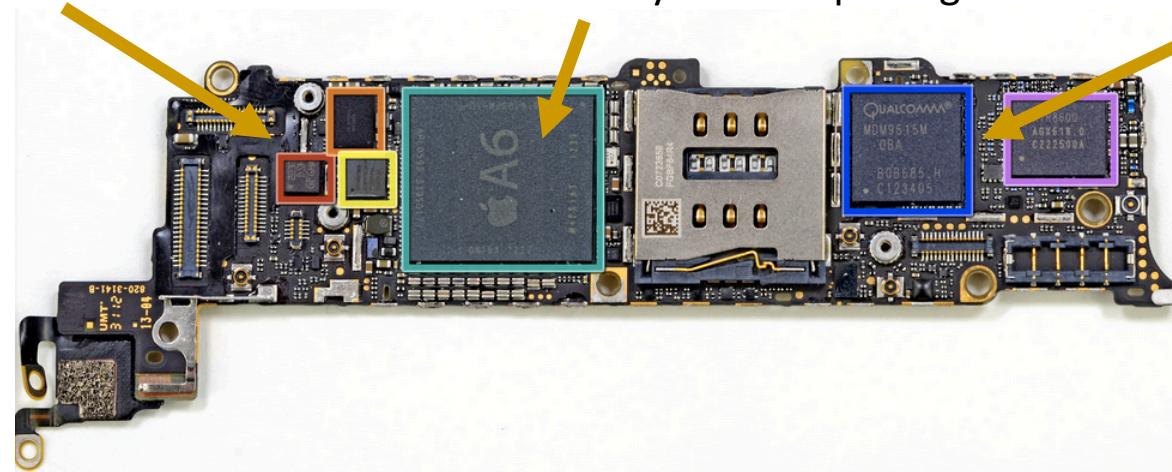
Example: iPhone 5s Deconstructed



I/O: Touch Screen,
accelerometer

P+M: 2 ARM cores, PowerVR
GPU, image/video processor;
DRAM memory in same package

I/O: LTE modem, RF
transceiver



I/O: Wireless
antenna,
amplifier,
duplexer

Power
Management

M: Flash
Memory

I/O: Audio, WiFi,
Gyroscope

