CSE240C: Advanced Microarchitecture

Or: Advanced Not Parallel Architecture

Scope

- Everything in architecture that is not parallel.
  - Really, everything not “coarse-grain” parallel.
  - We might fudge a little bit on this.

240C Goals

- Get a broad picture of architecture
  - There is much more than 240a
- This class has a strong "meta" component
  - Paper reading skills
  - Presentation skills
  - Synthesis skills
- Do an exciting research project

Content

- Historical perspectives
- New approaches to out-of-order execution (i.e., exploiting ILP)
- Specialized architectures.
- Circuit-level issues
- Multi-threading
- Case studies of real machines
- “super brainiac” processors
- Program analysis and behavior.
- Reliability issues.

Mechanics

- Reading papers
- Becoming an expert
- Research projects
- No tests!

Reading papers

- 18 Class meetings, about 36 papers
- Discussion format
  - Class is discussion-based. This means you!
  - Part 1: Answer questions from previous day
  - Part II: New material.

Assignments: Paper reading

- Read and *think about* each paper.
- Submit a summary.
- It is essential that you do this. Your grade depends substantially upon it.
- It is also essential that you learn to do this well.
  - Extracting content from papers is one of

Paper summaries

- Goal 1: Extract the good ideas from the paper.
  - This means discarding the junk.
  - Identifying the good parts.
- Goal 2: Understand how it fits into its context (i.e., the rest of architecture)
  - How is it similar/different/an extension of...?

What's the paper's goal?

- Does it solve a problem?
- Demonstrate an opportunity?
- Does it provide information?

What does it contribute?

- An idea?
- A mechanism?
- A description of an artifact?
- A methodology?

How do the authors substantiate their claims?

- Experiments?
  - Real systems?
    - Simulation?
- Prose arguments?
- Examples from “the real world”

How does the paper relate to others?

- Refute?
- Confirm?
- Extend?
- Synthesize?
- Re-examine?
  - In light of new tech./new app./new idea

What conclusions do they draw?

- Small conclusions
  - Did their idea work?
  - How well?
  - Do you believe them?
- Big conclusions
  - How do they think it should shape the future?
  - Do you believe them?

How well is the paper crafted?

- Does it tell a story?
- Is it interesting?
- Are the figures easy to understand?
- Do they properly highlight the important parts?
- Could you summarize the paper after looking at it for 5 minutes? (not for this class, you can't ;-)

How would you improve the paper?

- Technically
  - Different approach (maybe you should write a paper?)
  - Methodology
  - Experiments
- Presentation
  - Organization
  - Additional background
  - Be concrete -- “make it more clear” is not useful.

What questions does it raise?

- Issues with their approach?
- Directions for new work?
- Broader questions about architecture?
- What didn't you understand?

Daily paper assignment

- Submitted via a google form (see website)
- Due 10 minutes before class -- no exceptions.
  - You should never miss class for this
- You should bring a printed version of each paper to class!

Becoming an expert

- In place of the mid term and exam...
- You will present 1-2 days worth of material in class
  - Become an expert on the topic.
  - Prepare 40 minutes of slides.
  - Collect and answer questions for the next day.

Class presentation timeline

- 2 weeks ahead: Meet with me about the topic.
- 1 week ahead: Send me a draft of your slides
- Present your slides, collect questions.
- Prepare and present answers
- Send me slides with answers

- *You* are responsible for tracking these deadlines.

Project

- You will complete a research-style project on a topic of your choosing.
- Work in groups of 2-3.
- Start thinking of topics now!
  - You've already had 240A, so you have plenty of idea fodder.
- More information to come.

Questions

- Did they care about touring completeness?
- When did the first OS show up?