15-740/18-740
Computer Architecture
Lecture 0: Announcements/Logistics

Prof. Onur Mutlu

Carnegie Mellon University

Summary

- First lecture: September 8 (Wed)

- Homework 0 – Part 1
  - Due September 8 (Wed)

- Homework 0 – Part 2
  - Due September 10 (Fri)

- First readings
  - Reviews due September 10

- Project ideas and groups
  - Read, think, and brainstorm
  - Proposal due September 27

Agenda

- Syllabus
  - Course logistics, info, requirements

- Homework 0

- Readings for first lecture

Course Info: Who Are We?

- Instructor: Prof. Onur Mutlu
  - onur@cmu.edu
  - Office: Hamerschlag Hall-A305
  - Office Hours: W 2:30-3:30pm (or by appointment)
  - http://www.ece.cmu.edu/~omutlu
  - PhD from UT-Austin, worked at Microsoft Research, Intel, AMD
  - Research:
    - Computer architecture
    - Many-core systems: shared resources, asymmetric multi-core
    - Memory systems
    - Interconnection networks
    - Hardware/software interaction and co-design
    - Fault tolerance
    - Hardware security
    - Algorithms and architectures for genomics

Course Info: Who Are We?

- Teaching Assistants
  - Vivek Seshadri
    - GHC 7517
    - vseshadr@cs.cmu.edu
  - Evangelos Vlachos
    - HH A312
    - evlachos@ece.cmu.edu
  - Office hours TBD

- Course Administrative Assistant
  - Bara Ammoura
    - bammoura@ece.cmu.edu

Where to Get Up-to-date Course Info?

- Website: http://www.ece.cmu.edu/~ece740

- Blackboard: Linked from website
  - Lecture notes
  - Readings
  - Project info
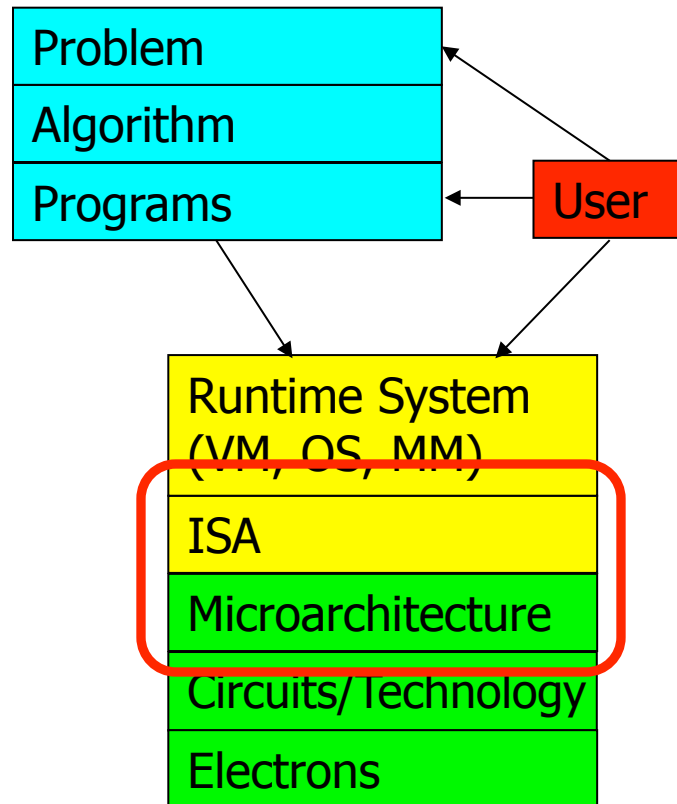 - Discussion boards – share information

- Your email

- Me and the TAs

What Will You Learn?

- **Computer Architecture:** The science and art of designing, selecting, and interconnecting hardware components and designing the hardware/software interface to create a computing system that meets functional, performance, energy consumption, cost, and other specific goals.

- **Traditional definition:** "The term *architecture* is used here to describe the attributes of a system as seen by the programmer, i.e., the conceptual structure and functional behavior as distinct from the organization of the dataflow and controls, the logic design, and the physical implementation." *Gene Amdahl*, IBM Journal of R&D, April 1964

Levels of Transformation

Problem
Algorithm
Programs
User
Runtime System (VM, OS, MM)
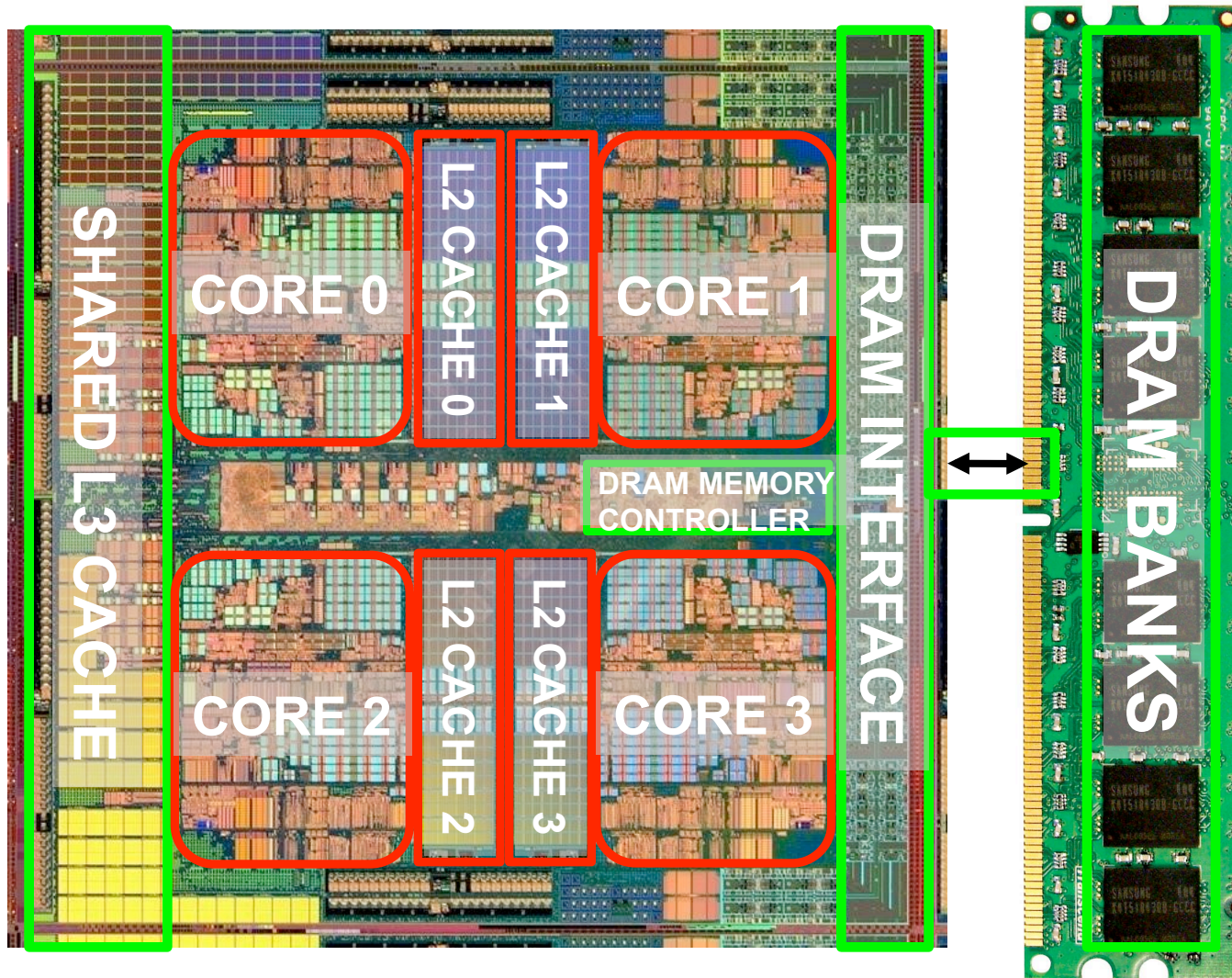ISA
Microarchitecture
Circuits/Technology
Electrons

What Will You Learn?

- Hardware/software interface and major components of a modern microprocessor
  - State-of-the-art as well as research proposals
  - Tradeoffs and how to make them
  - Emphasis on cutting-edge research

- Hands-on research in a computer architecture topic
  - Semester-long project
  - How to design better architectures (not an intro course)

- How to dig out information
  - No textbook really required
  - But, see the syllabus
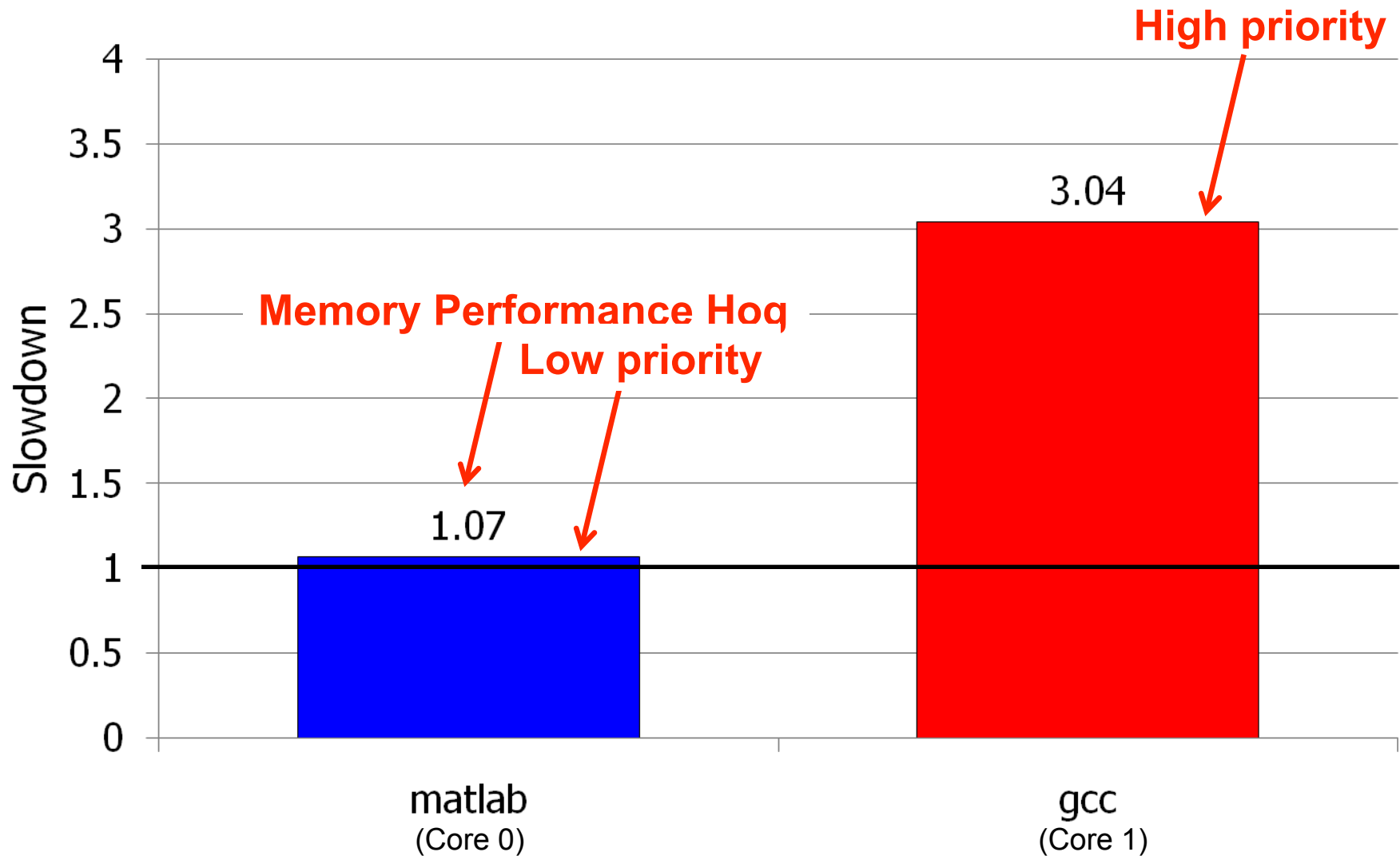
An Example: Multi-Core Systems
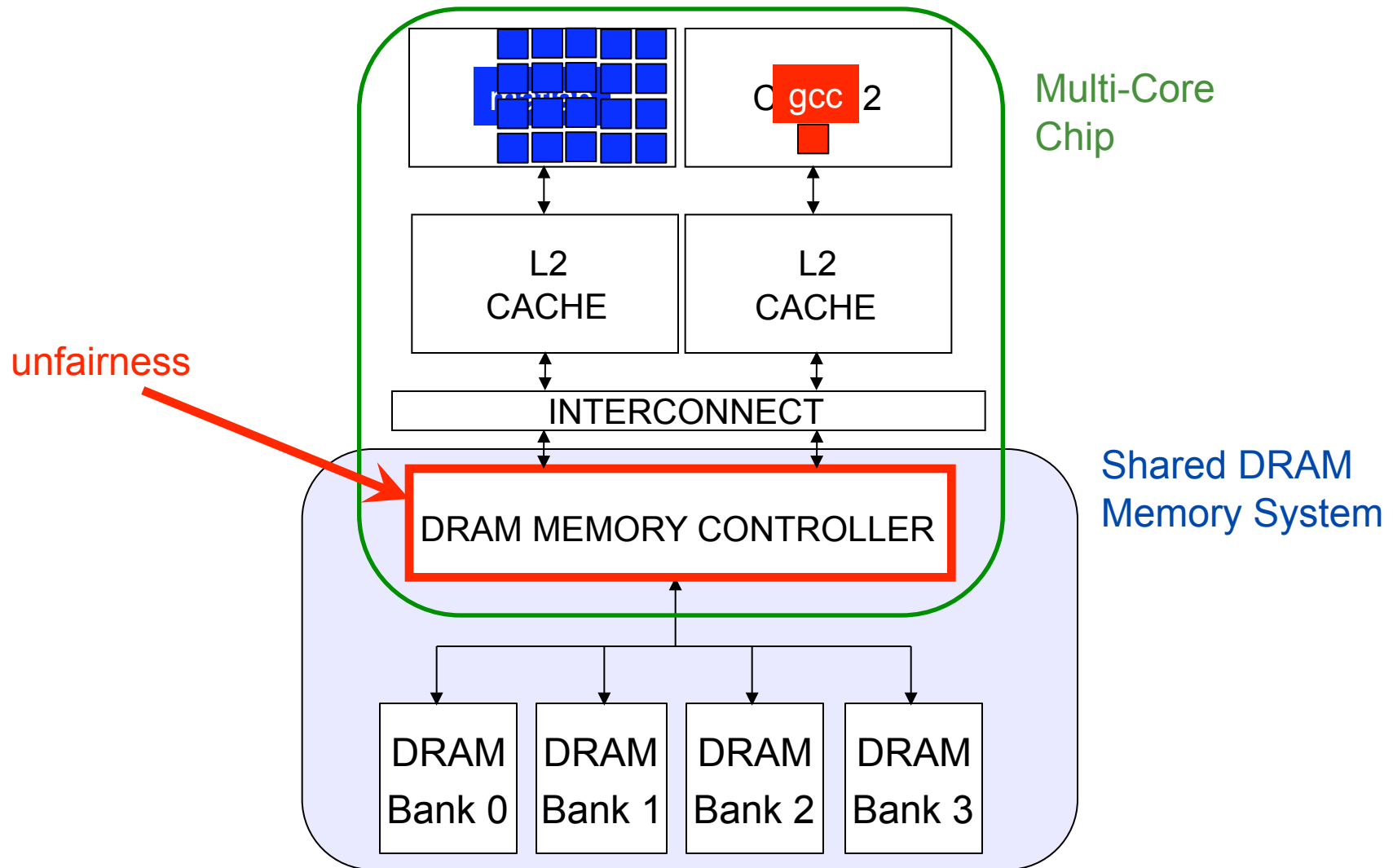
Multi-Core
Chip

CORE 0   L2 CACHE 0   L2 CACHE 1   CORE 1

SHARED L3 CACHE

DRAM MEMORY CONTROLLER

DRAM INTERFACE

CORE 2   L2 CACHE 2   L2 CACHE 3   CORE 3

DRAM BANKS

*Die photo credit: AMD Barcelona

Unexpected Slowdowns in Multi-Core

Why the Disparity in Slowdowns?

Multi-Core Chip

Shared DRAM Memory System

unfairness

matlab

gcc

L2 CACHE

L2 CACHE

INTERCONNECT

DRAM MEMORY CONTROLLER

DRAM Bank 0

DRAM Bank 1

DRAM Bank 2

DRAM Bank 3

What Do I Expect From You?

- Required background: basic architecture (18-447), basic compilers, basic OS, programming

- Learn the material
  - And, research it
- Do the work & work hard
- **Ask questions, take notes**
- Read and review the assigned research papers & readings
  - Discuss/critique them online with peers and us
  - Write your critique/review online
- Study in groups, but submit your own work
- Start early and focus on the research project
- If you want feedback, come to office hours

How Will You Be Evaluated?

- Homeworks, Online Reviews, Quizzes: 10%

- Research Project: 35%

- Midterm I: 20%

- Midterm II (comprehensive): 35%

- Our evaluation of your performance: 5%

- Participation+discussion counts

More on Homeworks and Policy

- Content from lectures, readings, project, discussions
- All homeworks *must* be your own work

- Research project in groups

- Late policy: Maximum five late days total

- Honor code: No tolerance on cheating, academic dishonesty
  - See syllabus

Research Project

- Your chance to explore in depth a computer architecture topic that interests you

- Perhaps even publish your innovation in a top computer architecture conference.

- Start thinking about your project topic from now!

- Interact with me and Evangelos & Vivek

- Groups of 2-3 students (will finalize this later)

- Proposal due: Sep 27

Homework 0

- **Part 1**
  - Our way of getting to know about you fast
  - Due Sep 8

- **Part 2**
  - Four readings
  - One cache question
  - Due Sep 10

- **Paper Reviews**
  - Write **brief** reviews online for the four readings
  - Key ideas, strengths, weaknesses, challenges, what did you learn? Are the statements valid, interesting, exciting?
  - Due Sep 10

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