Computer Architecture

Lecture 2b: Course Logistics

Prof. Onur Mutlu
ETH Zürich

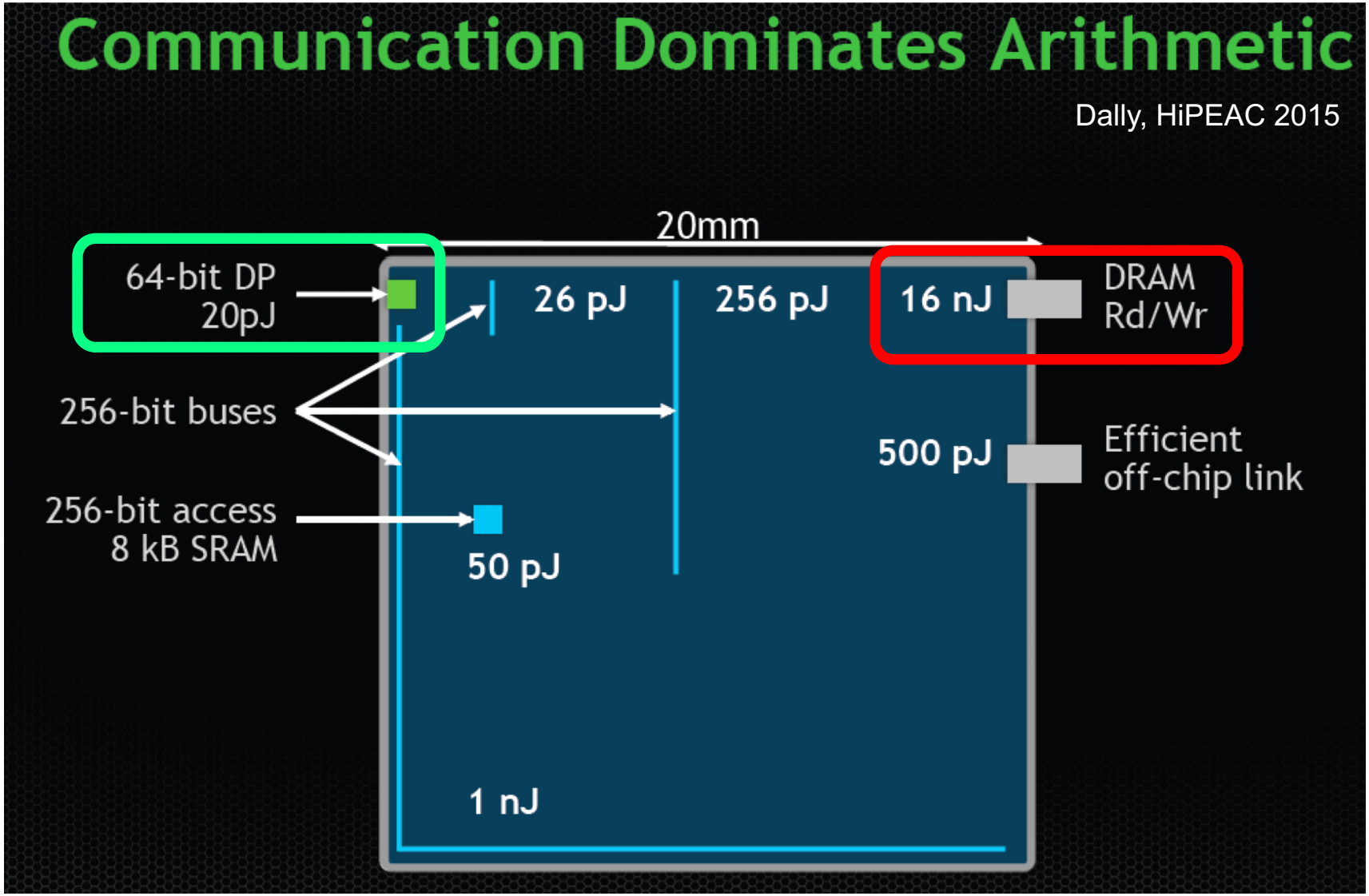
Fall 2019

20 September 2019

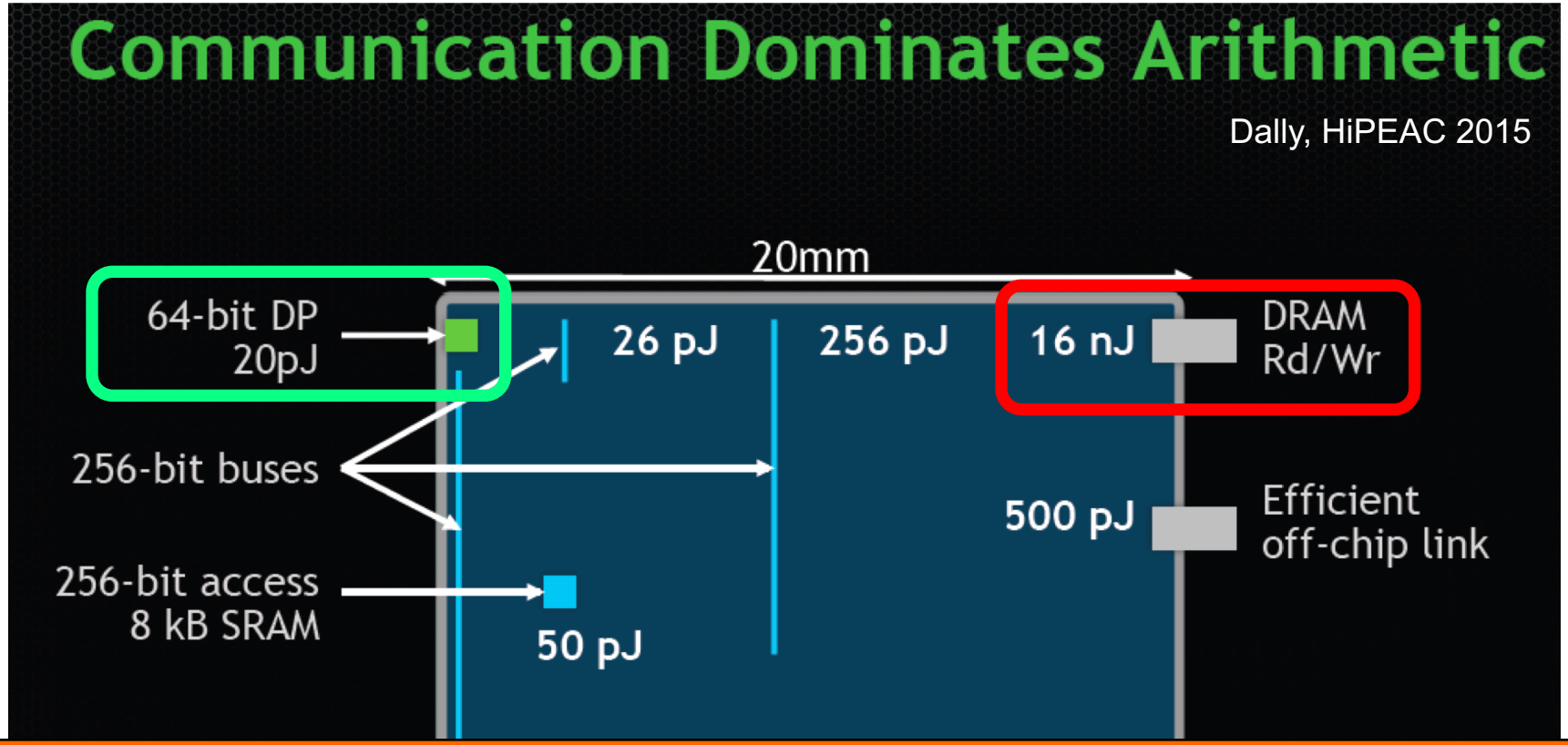
Increasingly Demanding Applications

- Dream, and they will come

Increasingly Diverging/Complex Tradeoffs



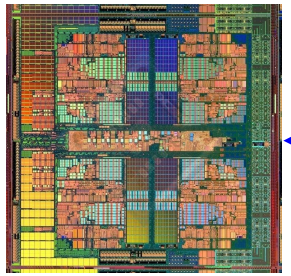
Increasingly Diverging/Complex Tradeoffs



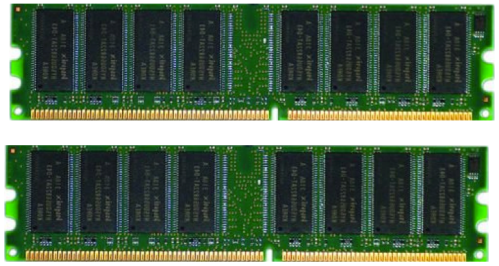
A memory access consumes ~1000X the energy of a complex addition

Increasingly Complex Systems

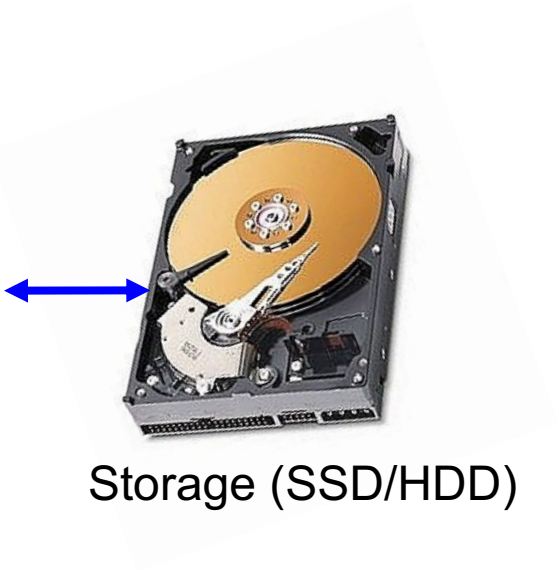
Past systems



Microprocessor



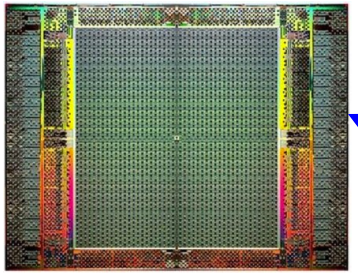
Main Memory



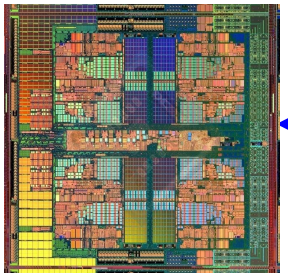
Storage (SSD/HDD)

Increasingly Complex Systems

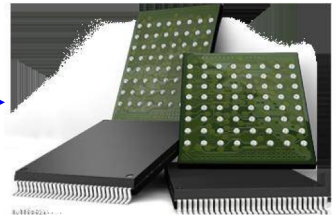
FPGAs



Modern systems

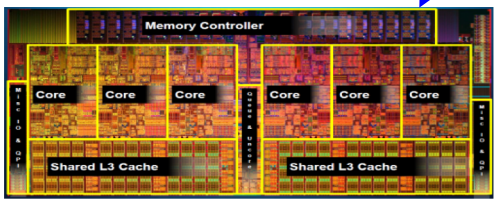


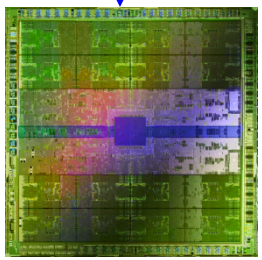
Hybrid Main Memory



Persistent Memory/Storage

Heterogeneous Processors and Accelerators





(General Purpose) GPUs

Recap: Some Goals of This Course

- Teach/enable/empower you to:
  - Understand how a computing platform works
  - Understand how decisions made in hardware affect the software/programmer as well as the hardware designer
  - Think critically (in solving problems)
  - Think broadly across the levels of transformation
  - Understand how to analyze and make tradeoffs in design
  - Apply the above in several lab projects and HWs

Course Info: Who Are We?

- Onur Mutlu
  - Full Professor @ ETH Zurich CS, since September 2015
  - Strecker Professor @ Carnegie Mellon University ECE/CS, 2009-2016, 2016-…
  - PhD from UT-Austin, worked at Google, VMware, Microsoft Research, Intel, AMD
  - https://people.inf.ethz.ch/omutlu/
  - omutlu@gmail.com (Best way to reach me)
  - https://people.inf.ethz.ch/omutlu/projects.htm
- Research and Teaching in:
  - Computer architecture, computer systems, hardware security, bioinformatics
  - Memory and storage systems
  - Hardware security, safety, predictability
  - Fault tolerance
  - Hardware/software cooperation
  - Architectures for bioinformatics, health, medicine
  - …

Course Info: Who Are We?

- Teaching Assistants
  - Dr. Mohammed Alser
  - Can Firtina
  - Geraldo F. de Oliveira Jr.
  - Hasan Hassan
  - Jeremie Kim
  - Dr. Juan Gomez Luna
  - Minesh Patel
  - Ivan Puddu
  - Giray Yaglikci

- Get to know them and their research

Review: Major High-Level Goals of This Course

- Understand the principles
- Understand the precedents

- Based on such understanding:
  - Enable you to evaluate tradeoffs of different designs and ideas
  - Enable you to develop principled designs
  - Enable you to develop novel, out-of-the-box designs

- The focus is on:
  - Principles, precedents, and how to use them for new designs

- In Computer Architecture

A Note on Hardware vs. Software

- This course might seem like it is only "Computer Hardware"
- However, you will be much more capable if you master both hardware and software (and the interface between them)
  - Can develop better software if you understand the hardware
  - Can design better hardware if you understand the software
  - Can design a better computing system if you understand both
- This course covers the HW/SW interface and microarchitecture
  - We will focus on tradeoffs and how they affect software

What Do I Expect From You?

- Required background: Digital circuits course, programming, an open mind willing to take in many exciting concepts.

- Learn the material thoroughly
  - attend lectures, do the readings, do the exercises, do the labs
- Work hard: this will be a hard, but fun & informative course
- Ask questions, take notes, participate
- Perform the assigned readings
- **Come to class, participate**
- Start early
- If you want feedback, come to office hours

- Remember "Chance favors the prepared mind." (Pasteur)

What Do I Expect From You?

- How you prepare and manage your time is very important

- There will be many lab and homework assignments
  - They will take time
  - Start early, work hard

- This will be a heavy course
  - However, you will learn a lot of fascinating topics and understand how a computing platform works
  - And, it will hopefully change how you look at and think about designs around you

How Will You Be Evaluated?

- Project assignments: 45%
- Midterm exam: 15%
- Final exam: 25%
- Homeworks: 15%

- More on this later

Course Goals

- Goal 1: To familiarize those interested in computer system design with both fundamental operation principles and design tradeoffs of processor, memory, and platform architectures in today's systems.
  - Strong emphasis on fundamentals, design tradeoffs, key current/future issues
  - Strong emphasis on looking backward, forward, up and down

- Goal 2: To provide the necessary background and experience to design, implement, and evaluate a modern processor by performing hands-on simulator implementation.
  - Strong emphasis on functionality, hands-on design & implementation, and efficiency.
  - Strong emphasis on making things work, realizing ideas

Course Website

- https://safari.ethz.ch/architecture/fall2019/doku.php
- All slides, lecture videos, readings, assignments to be posted
- Plus other useful information for the course
- Check frequently for announcements and due dates

Homework 0

- Due Sep 26
  - https://safari.ethz.ch/architecture/fall2019/lib/exe/fetch.php?media=hw0.pdf
- Information about yourself
- All future grading is predicated on homework 0

Heads Up

- We will have a few required review assignments
  - Due likely end of next week
- HW1 will be out early next week
  - Due in ~2 weeks
- Lab 1 will be out today
  - Due in ~2 weeks
- Check the website. Will also be announced in lecture

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