Computer Organization

Douglas Comer

Computer Science Department
Purdue University
250 N. University Street
West Lafayette, IN 47907-2066

http://www.cs.purdue.edu/people/comer

I

Course Introduction And Overview

The World Of Computers

- Computers are everywhere

  - Cell phones

  - Automobiles

  - Video games

  - Desktops

- Each uses software

Fundamental Question

Why should someone interested in building software study computer architecture to learn about the organization of the underlying hardware?

Why Study Computer Architecture?

- Makes it possible to write computer programs that are:

    - Faster

    - Smaller

    - Less prone to errors

- Allows programmers to appreciate relative cost of operations and the effect of programming choices

- Helps programmers debug

Why Study Computer Architecture?

- Makes it possible to write computer programs that are:

    - Faster

    - Smaller

    - Less prone to errors

- Allows programmers to appreciate relative cost of operations and the effect of programming choices

- Helps programmers debug

- It's a required course!

The Bad News

- Digital hardware

    – Is complex

    – Cannot be understood in one course

    – Requires background in electricity and electronics

The Good News

- It is possible to understand architectural components without knowing low-level technical details.

- Programmers only need to know the essentials

    - Characteristics of major components

    - Role in overall system

    - Consequences for programmers

Organization Of The Course

- Basics

  - A taste of digital logic

  - Data representations

- Processors

  - Types of processors

  - Instruction sets and operands

  - Assembly languages and programming

Organization Of The Course
(continued)

- Memory

  - Storage mechanisms

  - Physical and virtual memories and addressing

  - Caching

- Input/Output

  - Devices and interfaces

  - Buses and bus address spaces

  - Role of device drivers

Organization Of The Course
(continued)

- Advanced topics

    – Parallelism and parallel computers

    – Pipelining

    – Performance and performance assessment

    – Architectural hierarchy

What We Will Not Cover

- We choose breadth over depth

- Omissions

  - Low-level engineering details (e.g., discussion of electrical properties of resistance and the relationship to voltage and current)

  - Quantitative analysis of circuits that an engineer uses to design hardware

  - VLSI chip design

Computer Architecture

- Refers to overall organization of computer system

- Analogous to blueprint

- Specifies

    – Functionality of major components

    – Interconnection among components

- Abstracts away details

Design

- Needed before a computer can be built

- Translates architecture into practice

- Fills in details that architectural specification omits

- Specifies items such as

    – How components are grouped onto boards

    – How power is distributed to boards

- Many designs can satisfy a given architecture

Summary

- Understanding architecture helps programmers

- Course covers essentials of computer architecture

    - Digital logic

    - Processors, memory, I/O

    - Advanced topics such as parallelism and pipelining

- We will omit details and focus on concepts

Questions?