Introduction

Why Study Computer Architecture

- Makes it possible to write computer programs that are:
  - Faster
  - Smaller
  - Less prone to error
- 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

Computer Architecture

- Refers to overall organization of computer system
- Analogous to a 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 most details and focus on concepts.
Basic Structure of Computers

Basic Functional Units of a Computer

Connections Between Processor and Memory

Single-Bus Structure
Sharing of the Processor

Processor Cache

Main memory

Cache memory

Bus

Processor

Diagram showing the sharing of the processor over time with activities such as printer, disk, OS routines, and program.

Diagram illustrating the processor cache with main memory, cache memory, and bus connections.