

CS216: Program and Data Representation
University of Virginia Computer Science
Fall 2006 Michele Co

Class 2: Computer Abstractions

Classes of Computing Applications

- Desktop
 - Personal computer
- Servers
 - Web server
 - Supercomputer
- Embedded computers
 - Washing machine
 - Cell phone

Different design requirements, uses HW in different ways

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Understanding Program Performance

Hardware and Software Components

Component	Affects Performance:
Algorithm	# source-level statements, # I/O ops
Prog. Lang., compiler, architecture	# machine insts
Processor, memory system	How fast can insts be executed?
I/O system (HW + OS)	How fast can I/O ops execute?

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Terminology

- Systems software
 - Operating system
 - Interfaces between user program and hardware
 - Compiler
 - Translates program in high-level language to assembly language
 - Assembler
 - Translates assembly language program to machine language

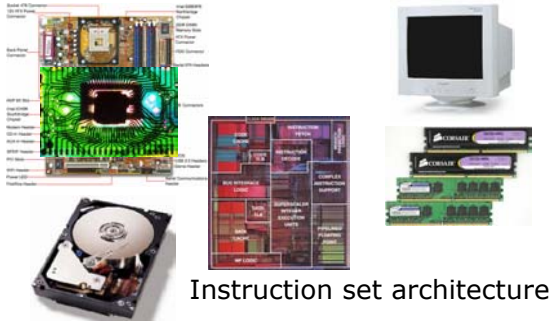
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Computer Basics

- Functions
 - Inputting data
 - Outputting data
 - Processing data
 - Storing data
- Components
 - Input
 - Output
 - Memory
 - Datapath (ALU)
 - Control

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Components



Instruction set architecture

Brief History of Technology

expensive, large, unreliable

- 1951 – Vacuum tube
- 1965 – Transistor
- 1975 – Integrated circuit
- 1995 – Very large scale integrated circuit
- 2005 – Ultra large scale integrated circuit

cheaper, smaller, reliable

Vacuum Tubes – 1946-59



- ENIAC (WWII)
 - Eckert and Mauchly (UPenn)
 - 18,000 vacuum tubes, 1500 electronic relays
 - hardwired programs
- Stored program concept
 - Von Neumann
- EDSAC
 - First operational stored program computer



Transistors 1959-64

- 1/10 size of vacuum tube
- Lower operating temperature → longer life

Integrated Circuits – 1964-1975

- Kilby of Texas Instruments
 - Idea to build entire circuits on semiconducting material
 - 10 – 10,000 components per chip
- Computers became smaller



IBM System/360

VLSI and Ultra VLSI

- Millions to billions of transistors on a chip

Basic Definitions and Conventions

- Decimal
- Binary
- Hexadecimal

Problem 1.1

- PowerPC 601 processor addresses 2^{32} bytes of memory. What is the maximum number of 64-bit words that can be stored in this memory?

Problem 1.2

- A certain IBM 970 processor has a system clock frequency of 1.2 GHz, what is the clock period?

Problem 1.4

- How many 500 MB tapes will be required to back up a 120 GB hard drive? How long will the backup process take if one tape can be filled in 5 minutes?