How is data represented inside the computer (and what are the implications to users)?

How is a computer system organized?

What are the important factors relating to the central processor and primary storage?

Secondary storage:

- What is it?
- Why is it important?
- What performance factors should we consider?
- What are the secondary storage options?
How is data represented inside the computer (and what are the implications to users)?

Overview

- Binary Digit
  - Numbers
    - Integer
  - Floating Point
    - Arithmetic
    - No arithmetic
  - Characters

ANSI “A” = 0100 0001 (binary) = 65 (base 10)
ANSI “5” = 0011 0101 (binary) = 53 (base 10)
Integer 5 = 101 (binary)

“5” and 5 are not the same!

The more binary bits used, the larger the numeric magnitude
All decimal integers have exact binary equivalents
Most decimal fractions (e.g., 1.1) can only be approximated in the binary number system – using more bits reduces the approximation (representation) error
How is a computer system organized?

- Control Unit
- Arithmetic/Logic Unit (ALU)
- Primary Storage (Memory)

System Bus

Speed is determined by the slowest component

Demo – Configure a new computer
What are the important factors relating to the central processor and primary storage?

- CPU families
- Machine language
- Speed of the CPU
  - Hertz (Hz) - cycles per second
  - MIPS [Millions] [Marketing] [Meaningless]
  - Instructions Per Second
- RISC vs CISC
- Benchmarking
- Demo - iCOMP charts
**Secondary storage - What is it/Why important?**

Nonvolatile (permanent)

- **Nano**
  - Speed
  - Cost/mb: low (pennies)

- **Mili**
  - Secondary Storage
  - Cost/mb: low (pennies)

- **Gap**
  - Cost/mb: high (tens of dollars)

- **RAM**
  - Speed
  - Cost/mb: high (tens of dollars)
Secondary storage - What performance factors should we consider?

- Capacity
- Access time
- Transfer rate
- Reliability
- Internal versus external
- Fixed versus removable
- Cost factors
Secondary storage - What are the secondary storage options?

Magnetic hard disks (fast, expensive, large capacity, vulnerable to failure)
- Fixed HD
- Removable HD

Flexible magnetic disks
- Floppy (slow, cheap, low capacity, vulnerable to failure)
- Bernoulli (similar to HD - slightly below HD except cost)

Optical (high capacity, slower, cheap, high reliability)
- CD-ROM
- CD-R
- Erasable
- CD-DVD (Sony DDU100E — 4.7GB, $599)
  - Others estimate 17 GB (double sided/double layers)

Other
- Flash memory (new developments - Intel StratFlash)