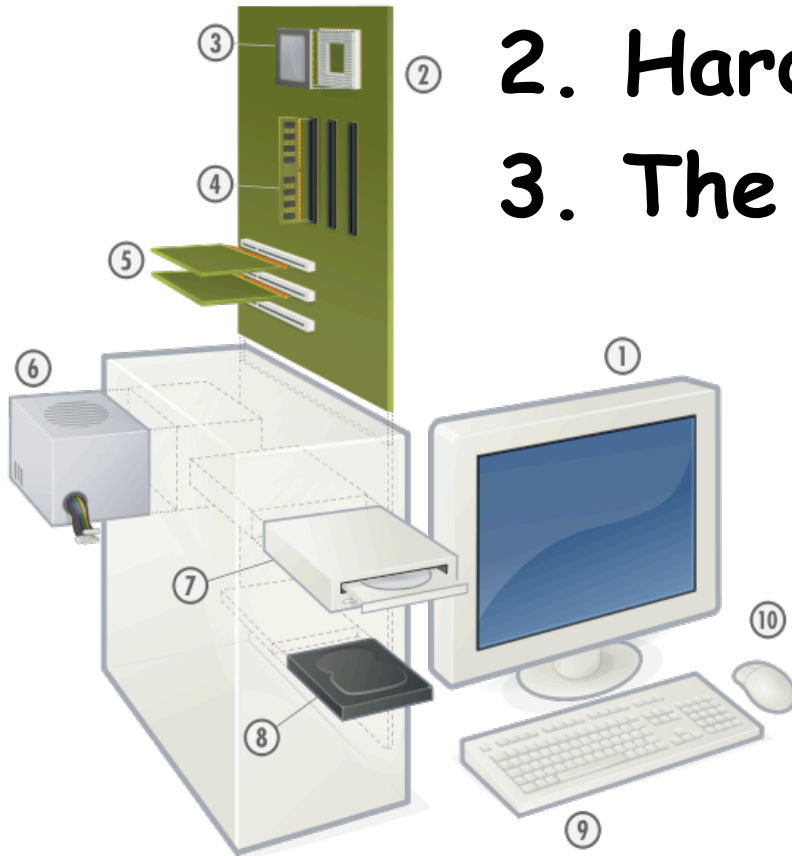


Computer Technologies

1. An Alien Autopsy
2. Hardware and Software
3. The WIMP interface



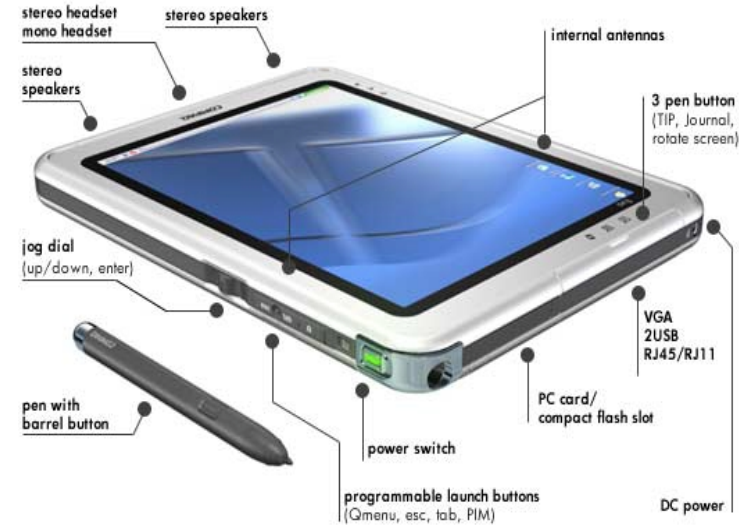
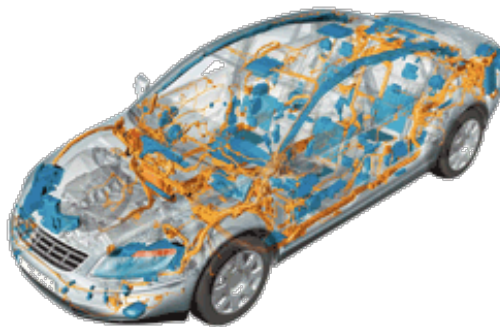
Computers Everywhere

- The computers we are used to
 - - Desktops
 - - Laptops



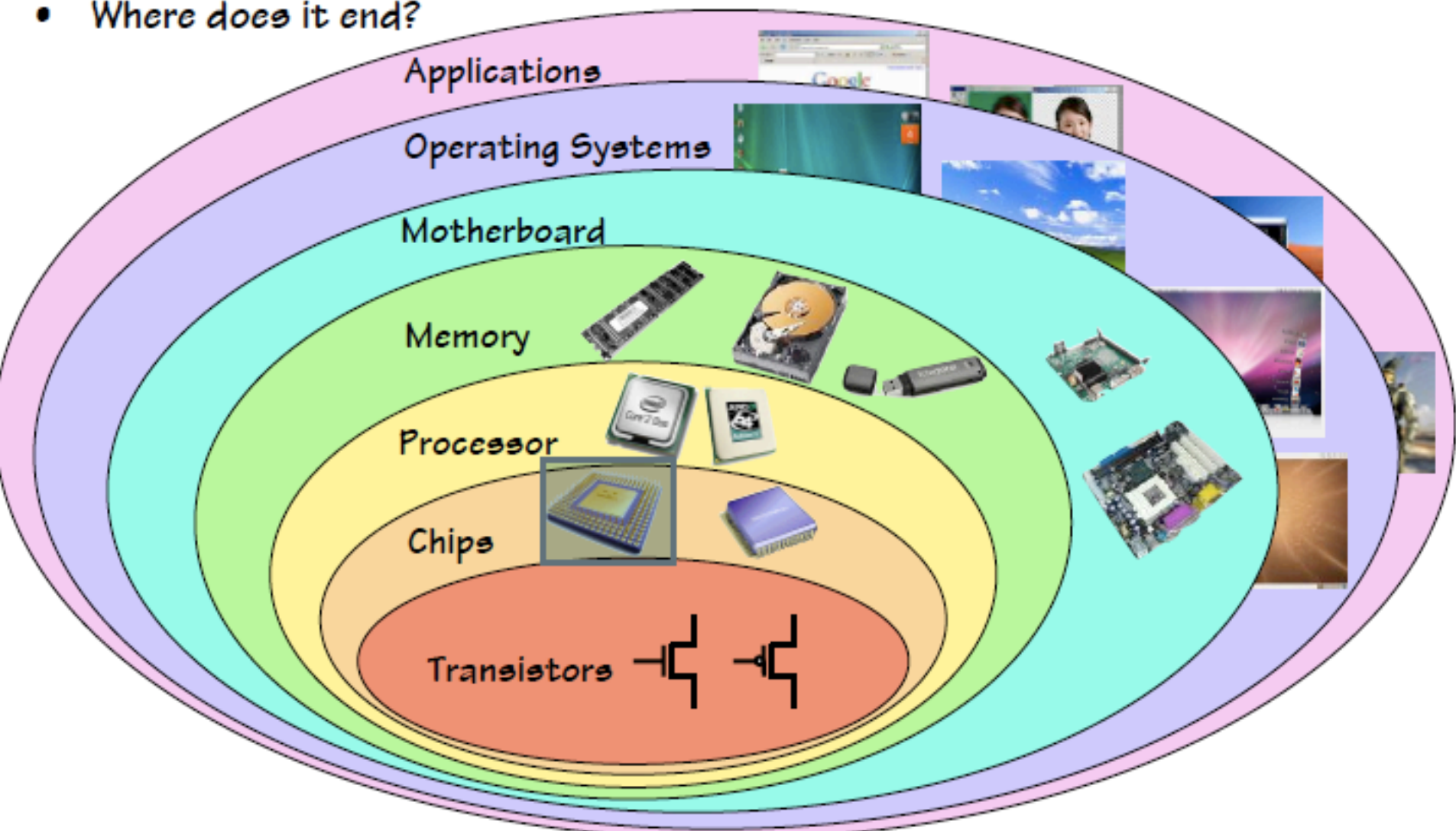
Embedded processors

- • Cars
- • Mobile phones
- • Toasters, irons, wristwatches, happy-meal toys



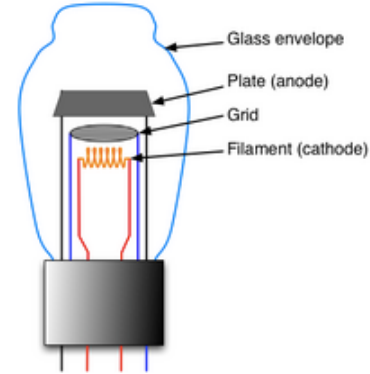
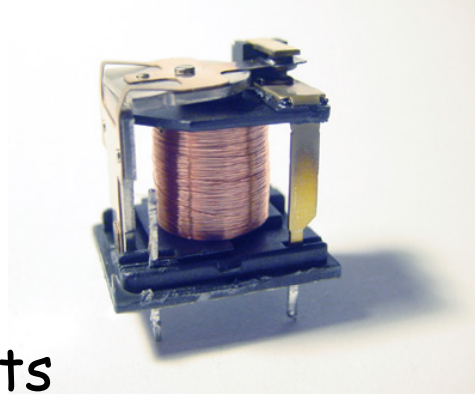
A Computer System

- What is a computer system?
- Where does it start?
- Where does it end?



Implementation Technology

- Relays
- Vacuum Tubes
- Transistors
- Integrated Circuits

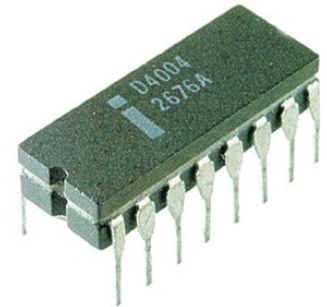
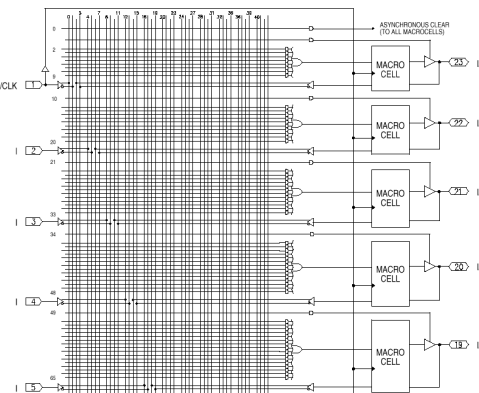
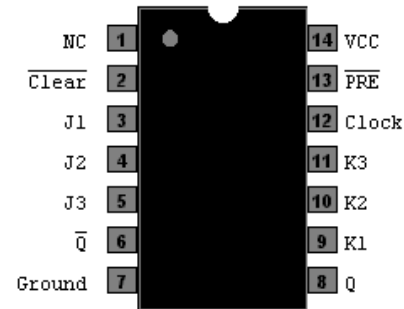


Gate-level integration

Medium Scale Integration (PALs)

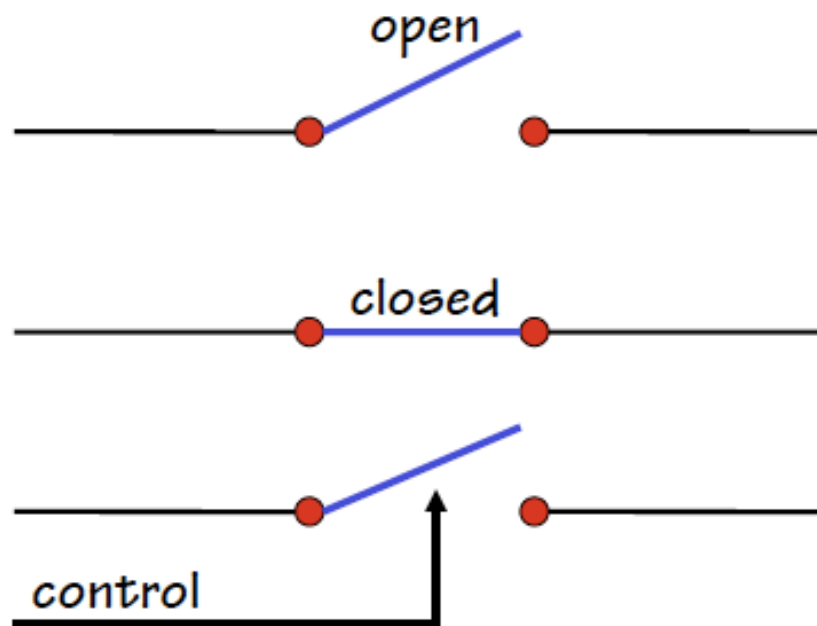
Large Scale Integration (Processing unit on a
Today (Multiple CPUs on a chip))

- Nanotubes??
- Quantum-Effect Devices??



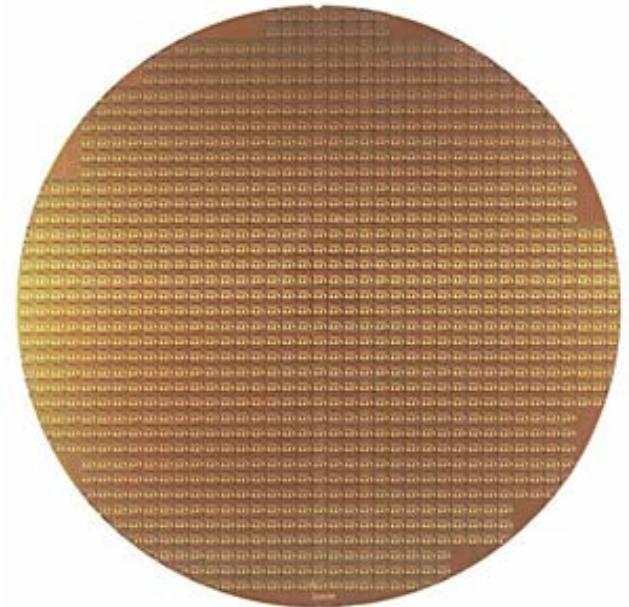
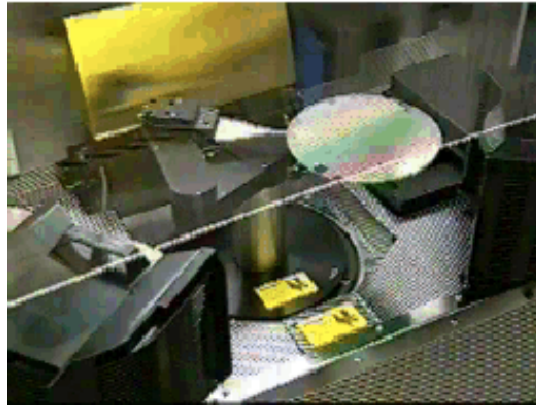
Implementation Technology

- Common Links?
- A controllable switch
- Computers are **wires** and **switches**



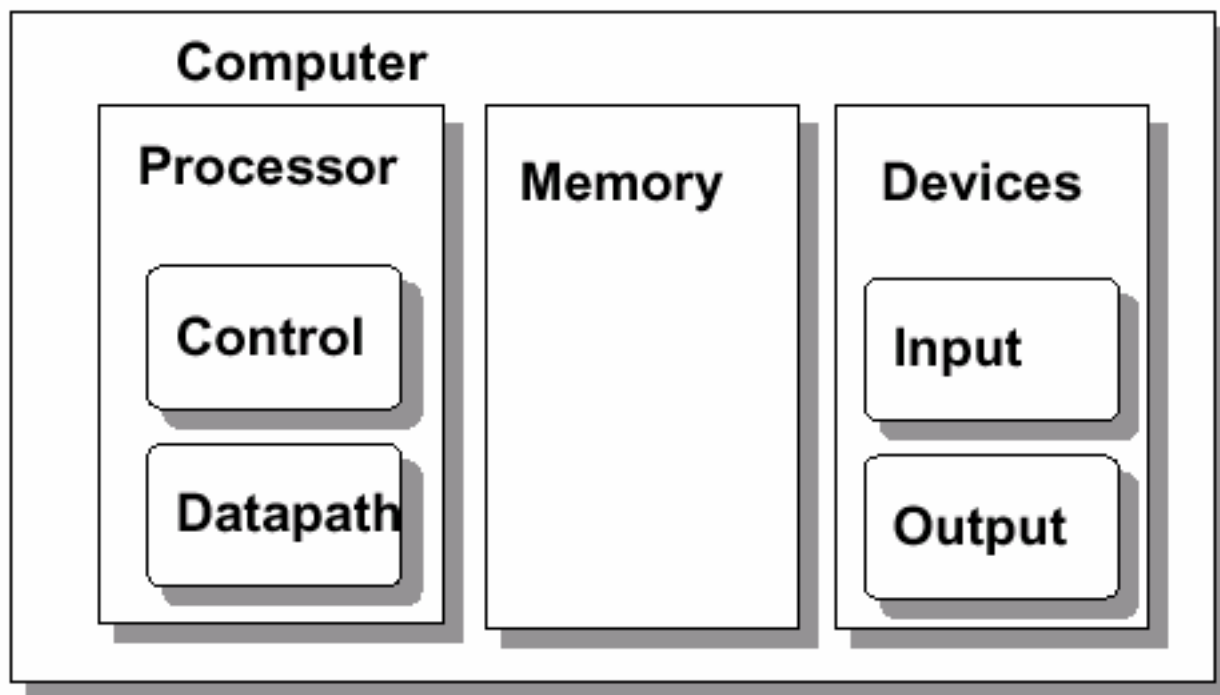
Chips

- Silicon Wafers
- Chip manufactures build many copies of the same circuit onto a single wafer. Only a certain percentage of the chips will work; those that work will run at different speeds. The yield decreases as the size of the chips increases and the feature size decreases.
- Wafers are processed by automated fabrication lines. To minimize the chance of contaminants ruining a process step, great care is taken to maintain a meticulously clean environment.



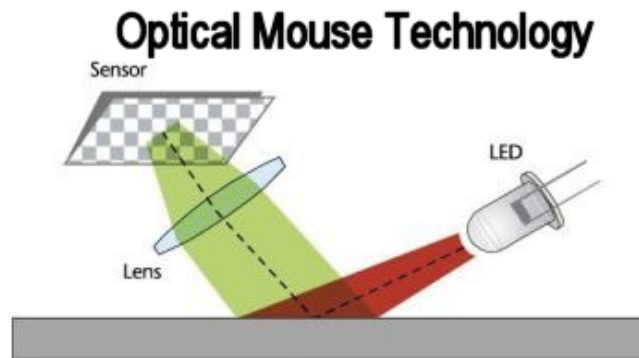
Under the Covers

- Input
- Output
- Storage
- Processing
 - Datapath
 - Control



Under the Covers

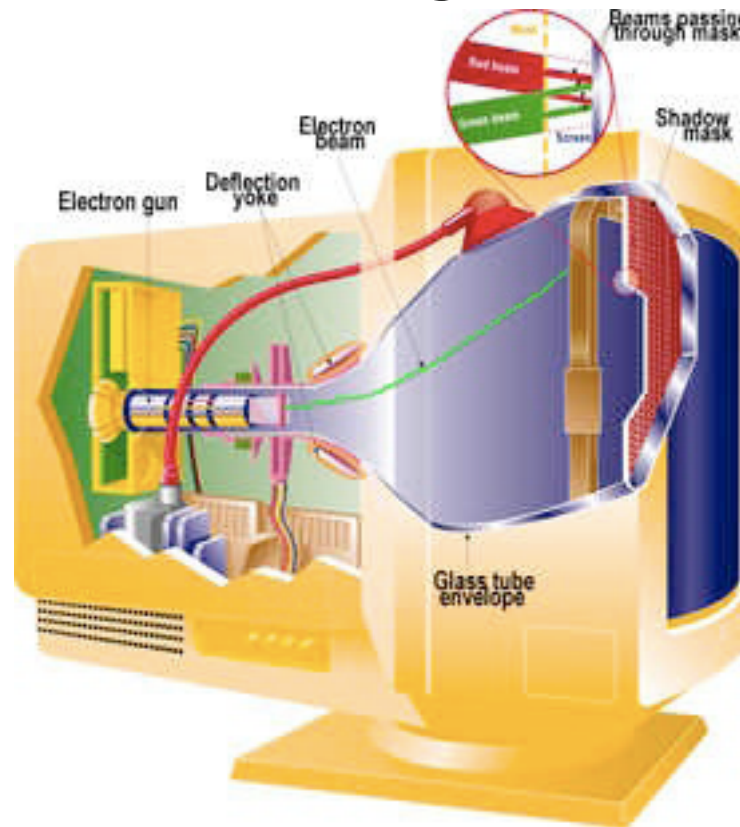
- Input
- Output
- Storage
- Processing
 - Datapath
 - Control



Under the Covers

Cathode Ray Tube (CRT)
The "last vacuum tube"
Now nearing extinction

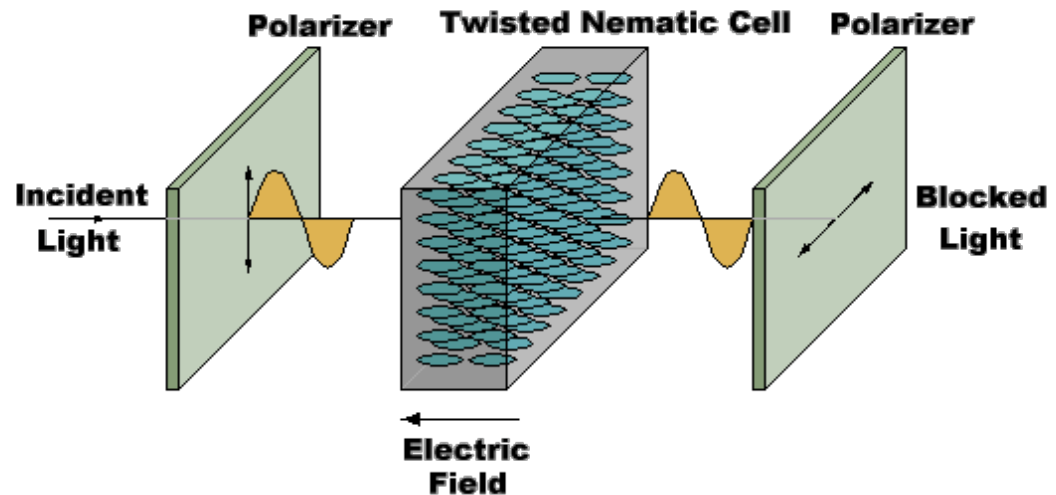
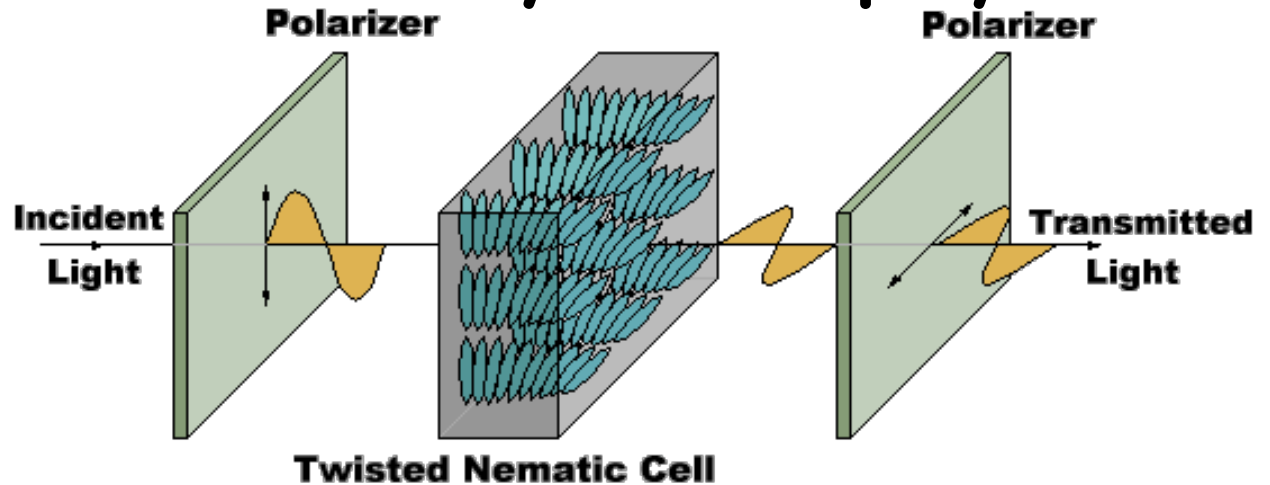
- Input
- Output
- Storage
- Processing
 - Datapath
 - Control



Under the Covers

- Input Liquid (LCDs)
- Output
- Storage
- Processing
 - Datapath
 - Control

Crystal Displays

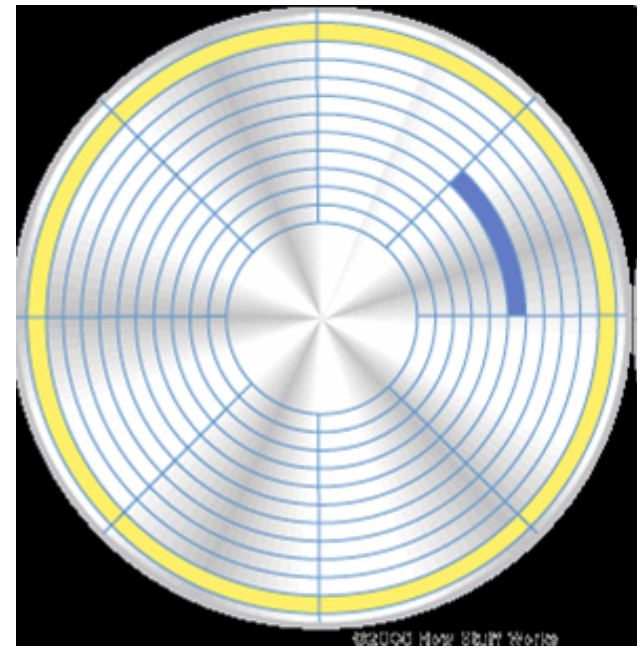


Under the Covers

- Input
- Output
- **Storage**
- Processing
 - Datapath
 - Control
- **Primary Storage** -
 - for active programs and data
- **Secondary Storage** -
 - for inactive programs and data
- **Memory Types**
- **RAM** - Random Access volatile Memory
- **ROM** - Read-Only non-volatile Memory
- **Cache** - A very fast memory for
 - accessing recently and frequently needed data
- **Flash** - A variant of ROM memory that
 - is infrequently written compared to how often it is read, and it is frequently read in blocks

Under the Covers

- Input
- Output
- Storage
- Processing
 - Datapath
 - Control



Under the Covers

- Input
- Output
- Storage
- Processing
 - Datapath
 - Control

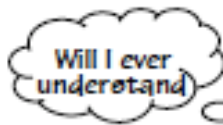


DRAM chip capacity

<u>Year</u>	<u>Size</u>
1980	64 Kb
1983	256 Kb
1986	1 Mb
1989	4 Mb
1992	16 Mb
1996	64 Mb
1999	256 Mb
2002	1 Gb
2004	4 Gb

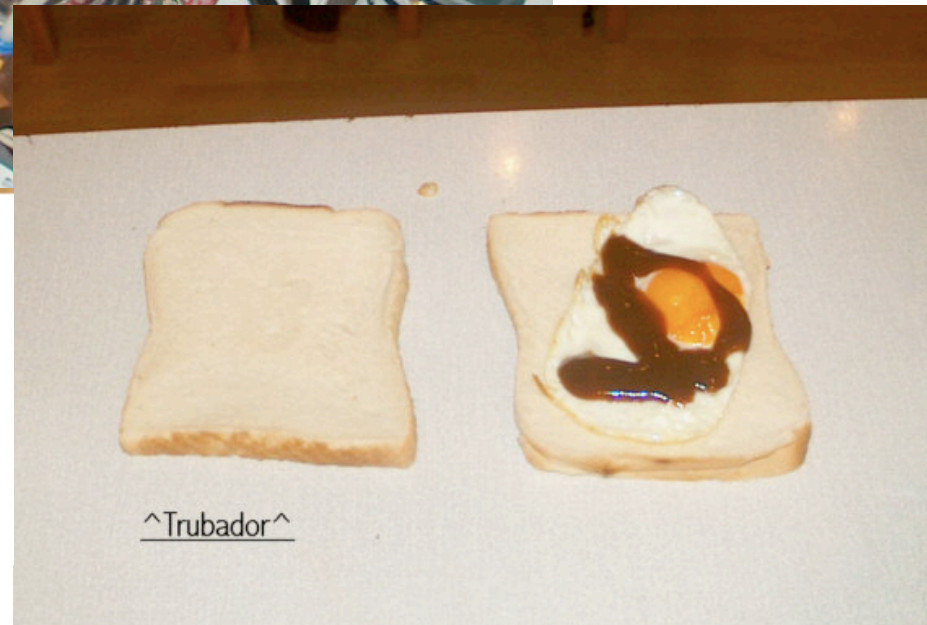
Issues for Modern Computers

- GHz Clock speeds
- Multiple Instructions per clock cycle
- Multi-core
- Memory Wall
- I/O bottlenecks
- Power Dissipation



Courtesy Troubador

- Technology Changes



SOFT-Ware?

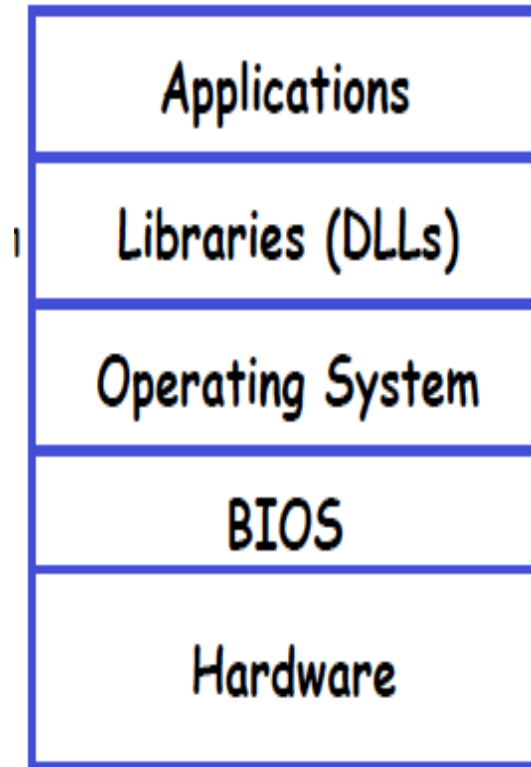
- Hardware is a ubiquitous terms that predates computers
- What exactly is SOFT about software?
- What makes computers different than other machines?
 - Their function is not strictly determined by their hardware, but they are reconfigurable via "SOFTWARE"
 - A collective term for "Computer Programs"
 - Software determines what operations the hardware performs
 - Software is broken into many modular parts

Computers are
digital Chameleons



Software Layer Cake

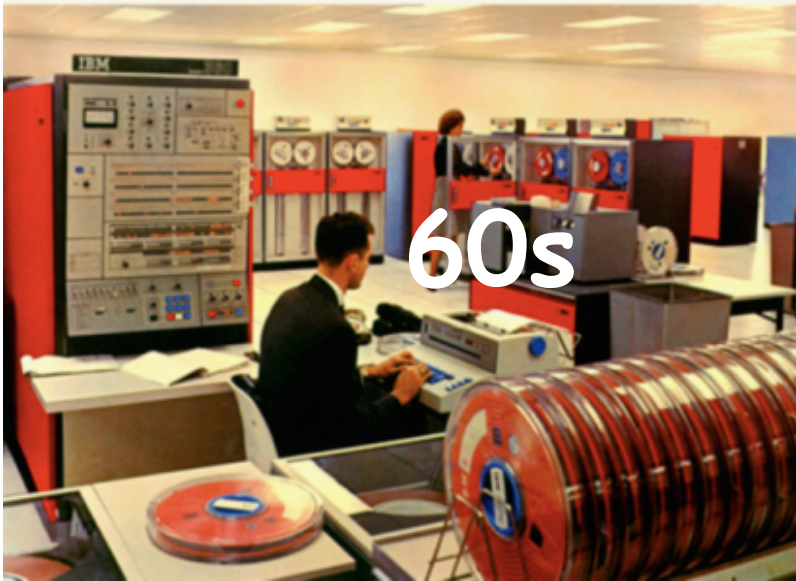
- Applications
 - Spreadsheets, Word Processing, Email, Media Player
- Shared Libraries
 - Opening a URL, MP3 coding & decoding, video player
- Operating System - Provides basic functions
 - timesharing, networking, file system
 - **Kernel** - The part of the OS that is always resident in memory
- BIOS - Basic Input/Output System
 - Controls hardware at the lowest level (reads keyboard, hard drive, etc). Sometimes called "firmware"
 - **Booting** (loads OS from disk into memory)
 - **Flashing** (updating BIOS)
- Hardware - the bare metal



5-min History on Computing for 50 Years of Progress

- Mainframes
- Mini's
- Workstations
- Personal Computer (PC)
- Laptop
- Palmtop
- Devices

Mainframes and Minis



The IBM 360 was the first family of compatible computers all designed to use common software. It propelled IBM to become the first BILLION dollar computer company. Only large companies could afford a mainframe computer. They were primarily used to process "batch" jobs.

In the 1960's an inexpensive alternative to the mainframe called the minicomputer was introduced, which could be purchased by departments. The Digital Equipment Corporation, was the pioneer of the mini. The original UNIX operating system, was developed for the PDP-11 minicomputer.

The mini was also widely used to develop early interactive programs



Workstation Era

The 1980's saw the introductions of both the personal computer and the engineering workstation. Workstations were "individual" computers, with "bit-mapped" graphical displays. They targeted designers and engineers, popularized networking, developed 3D graphics, and introduced Graphical User Interfaces (GUIs).



Apollo Workstation



SUN Sparcstation I



SGI IRIS 4D

The Personal Computer

- The development of the single chip

Central Processing Unit (CPU), called a "microprocessor" by Intel Corporation in the late '70s, enabled the creation of small desk computers. These computers were not only inexpensive, but they made popular graphically-rich Interactive computing.

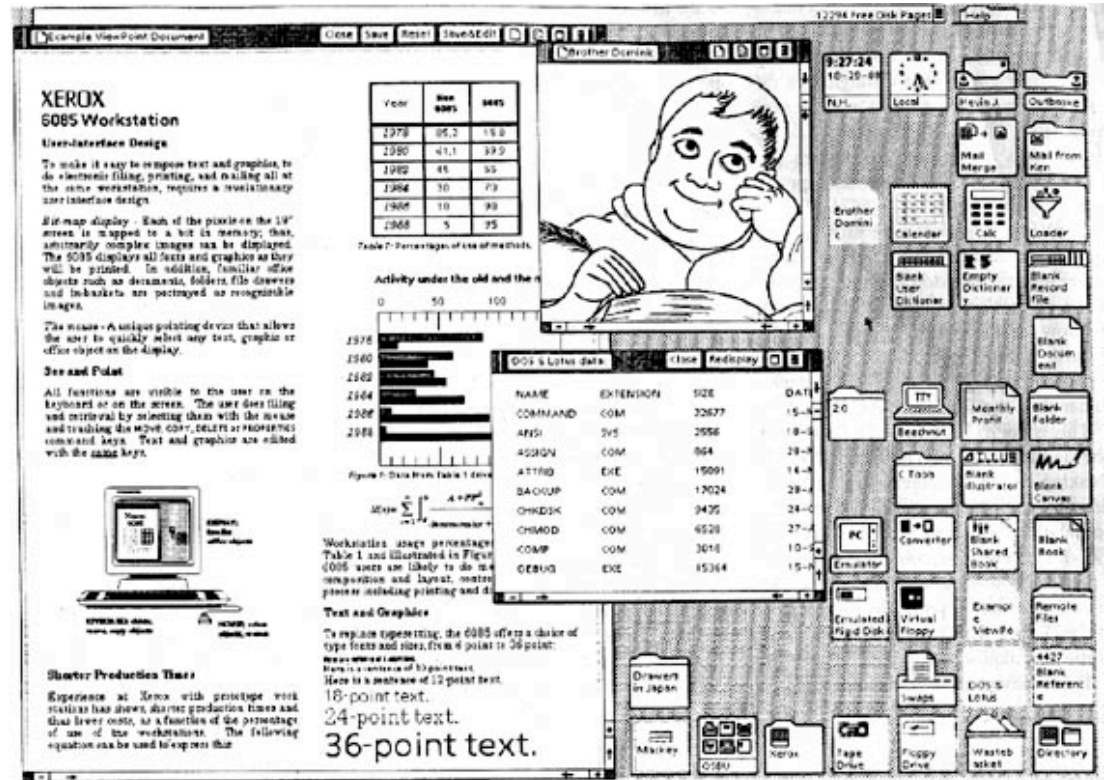


Mobile, Mobile, Mobile



Birth of the WIMP Interface

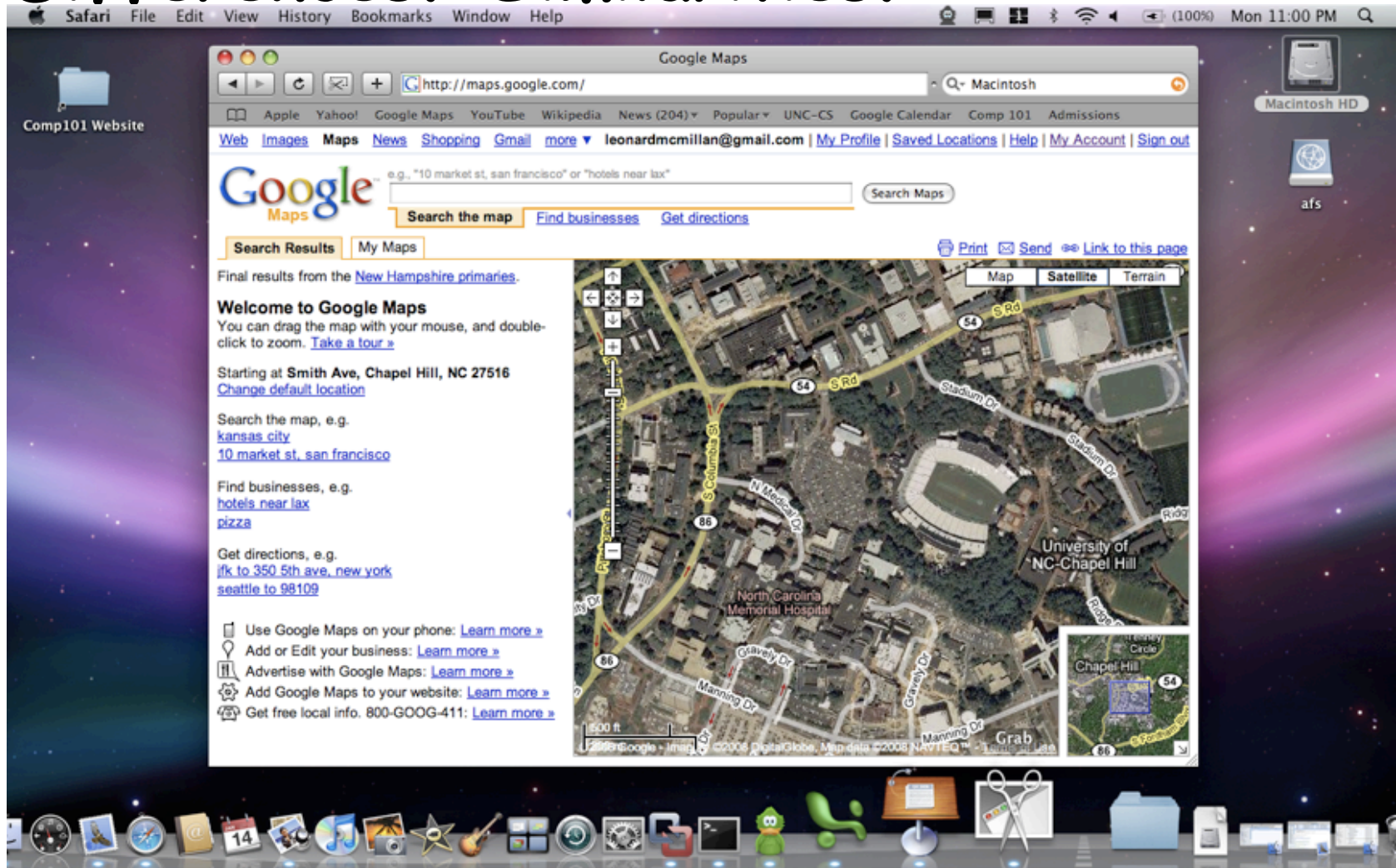
- Windows
- Icons
- Menus
- Pointing devices



The origins of today's graphical user interfaces can be traced back to the Xerox PARC Alto workstation. Xerox never sold the Alto, but they gave away nearly 100 to universities. They eventually tried to sell a version under the name "Xerox Star", but it was too late and overpriced. Steve Jobs of Apple computer saw the Alto, and was inspired by its user interface to develop the Lisa and later the Macintosh.

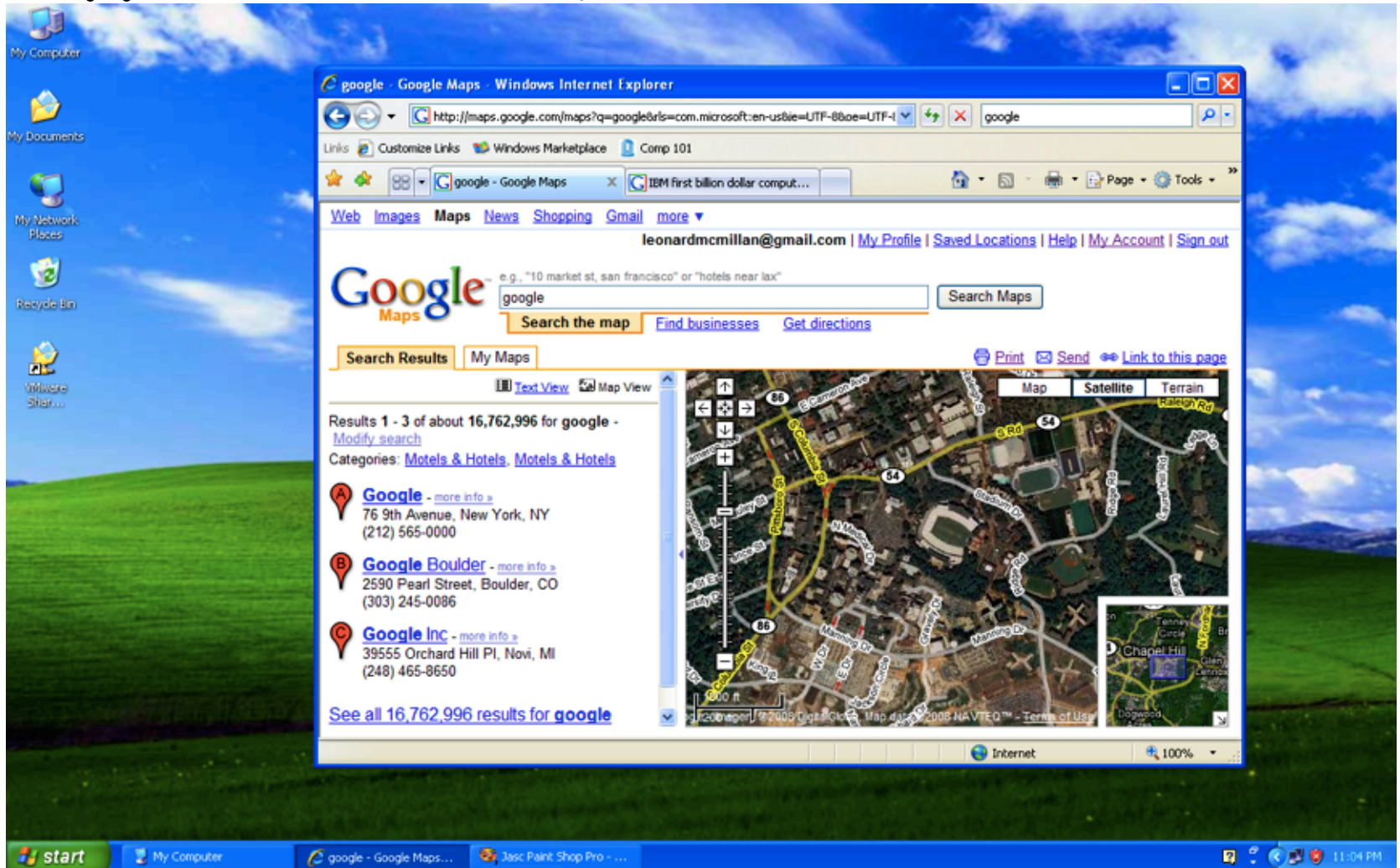
Today's Computer

• Differences? Similarities?



Today's Computer

- Differences? Similarities?



Today's Computer

• Differences? Similarities?

Applications Places System Leonard McMillan Tue Jan 15, 2:50 AM

Google Maps - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://maps.google.com/

Getting Started Latest BBC Headlines Comp 101

Web Images Maps News Shopping Gmail more

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Map Satellite Terrain

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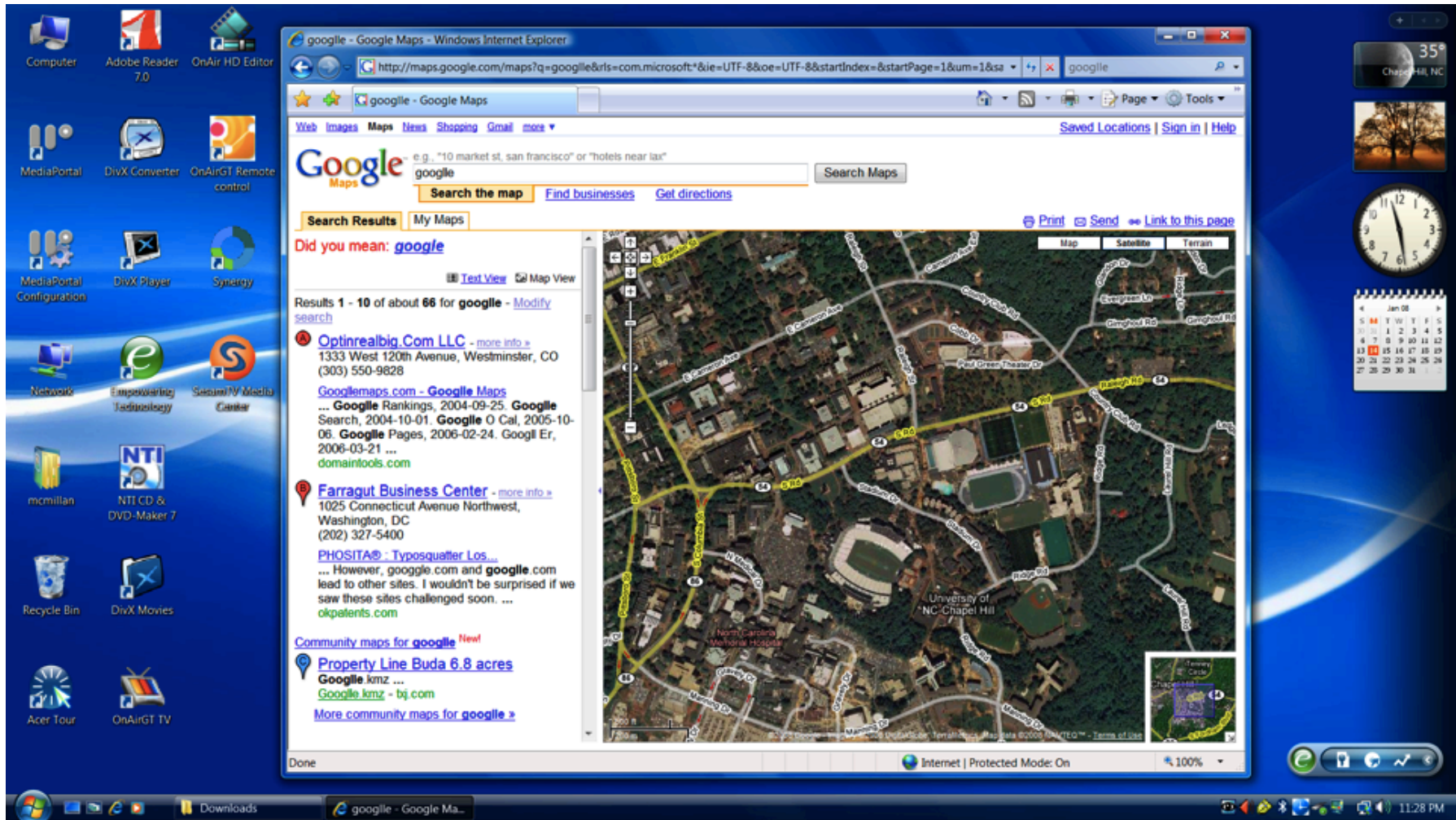
2000 ft

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Google Maps - Mozill...

Today's Computer

• Differences? Similarities?



WIMP IQ

- Do you know how to switch between running applications without using your mouse?
- How do you copy text from one application to another?
- How do you get to the "root" of your local file system?
- How do you delete a file from your computer?
 - Can you do it without a mouse?
 - Can you do it without copying it to the trash?
- Can you open the start menu without your mouse?
- Can you change icons?
- Can you make a shortcut, alias, link?
 - Why would you make one?

