

Introduction to Informatics

Lecture 6: History of Computers (part II)



Readings until now



- Lecture notes
 - Posted online @ <http://informatics.indiana.edu/rocha/i101>
 - *The Nature of Information*
 - *Technology*
 - @ *infoport* and web
- From course package
 - Von Baeyer, H.C. [2004]. *Information: The New Language of Science*. Harvard University Press.
 - Chapters 1, 4 (pages 1-12)
 - From Andy Clark's book "*Natural-Born Cyborgs*"
 - Chapters 2 and 6 (pages 19 - 67)



Assignment Situation

- Labs
 - Past
 - Lab 1: Blogs
 - Closed (Friday, January 19)
 - Lab 2: Basic HTML
 - **NEW Deadline:** Due this Wednesday, January 31
 - Lab 3: Advanced HTML: Cascading Style Sheets
 - Due Friday, February 2
 - Next: Lab 4
 - More HTML and CSS
 - Due Friday, February 9

Assignments

- Individual
 - First installment
 - Lecture 7: Thursday, February 1

Midterm Exam

- Week of February 26

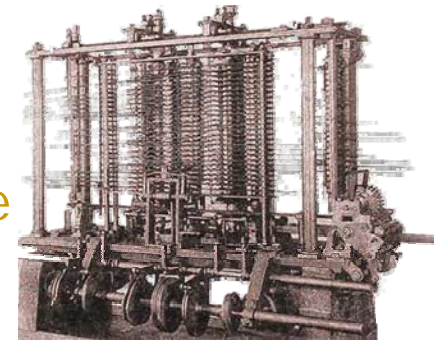
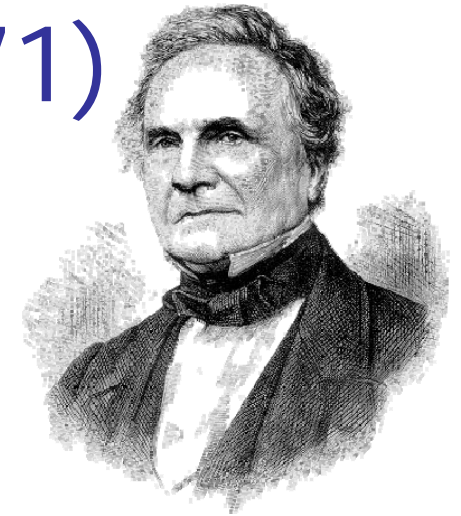


Charles Babbage (1791 – 1871)

- **Analytical Engine**

- Working with Ada Lovelace (daughter of Lord Byron) designed what was to have been a general-purpose mechanical digital computer.

- With a memory store and a central processing unit (or 'mill') and would have been able to select from among alternative actions consequent upon the outcome of its previous actions
 - Conditional branching: Choice, information
- Programmed with instructions contained on punched cards



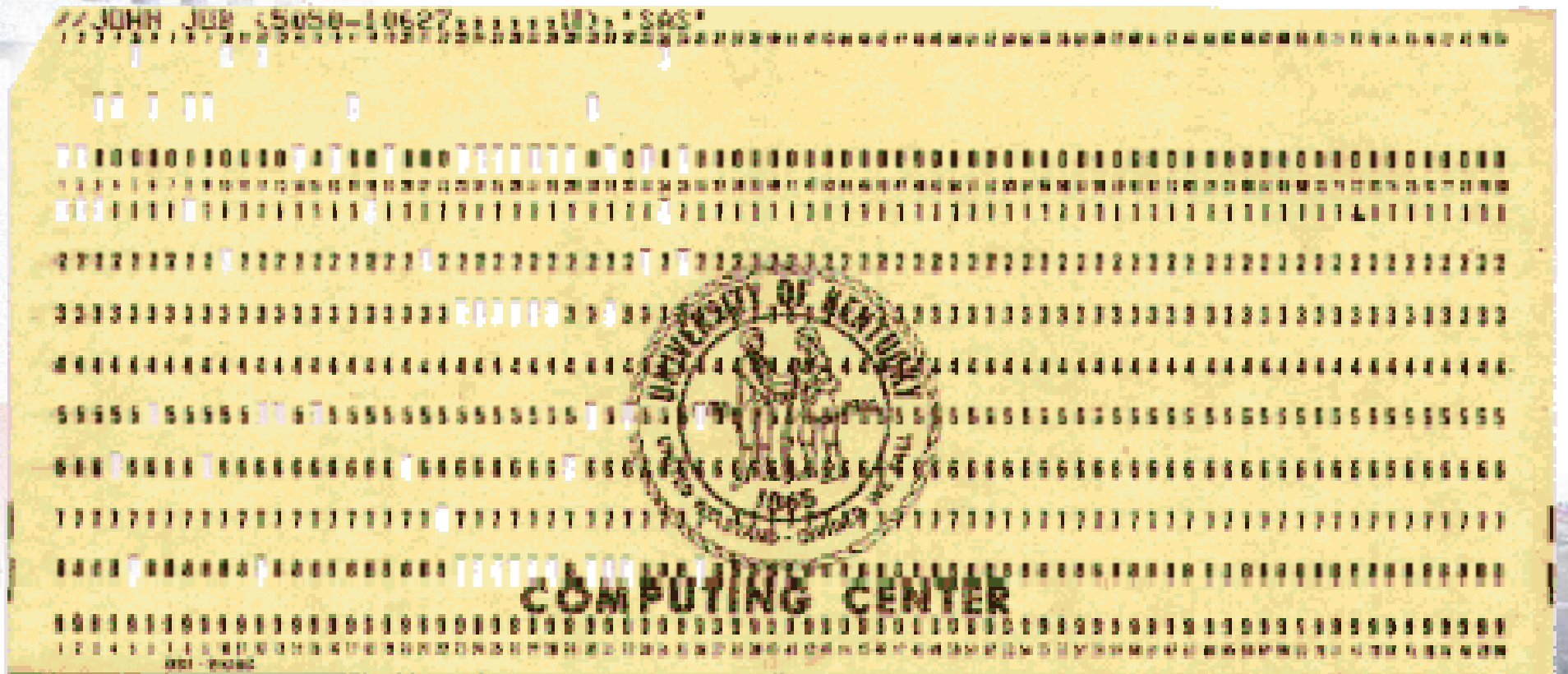
Herman Hollerith (1860-1929)

- Devised a system of encoding data on cards through a series of punched holes.
 - Hollerith's machine, used in the 1890 U.S. census, "read" the cards by passing them through electrical contacts. Closed circuits, which indicated hole positions, could then be selected and counted.
 - His Tabulating Machine Company (1896) was a predecessor to the International Business Machines Corporation (IBM)
- Reduced reading errors, work flow was increased, and, more important, stacks of punched cards could be used as an ***accessible memory store*** of almost unlimited capacity



Memory: Punch Card

- Binary Representation
 - Holes denote 1's
 - With 8 holes permissible $2^8 = 256$ numbers possible per column



Alan Turing (1912-1954)

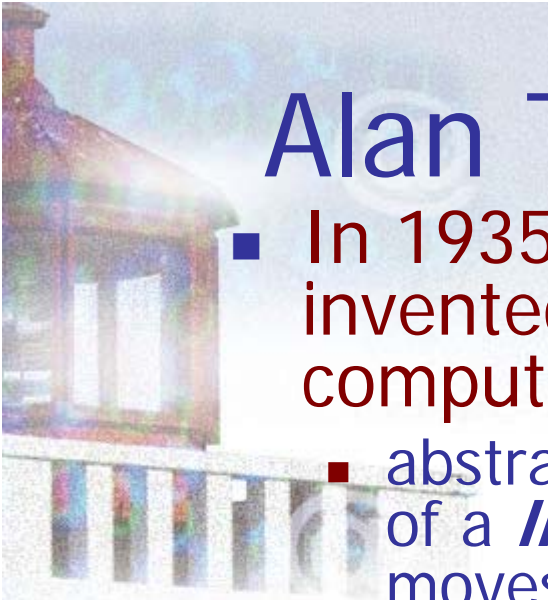


- In 1935, at Cambridge University, Turing invented the principle of the modern computer: ***Universal Turing Machine***.
 - abstract digital computing machine consisting of a ***limitless memory*** and a scanner that moves back and forth through the memory, symbol by symbol, reading what it finds and writing further symbols (Turing [1936]).

The actions of the scanner are dictated by a program of instructions that is stored in the memory in the form of symbols.

During the Second World War, Turing was a leading cryptanalyst at the Government Code and Cypher School, Bletchley Park.

- Breaking of the German code ENIGMA
- Prosecuted for homosexuality: forced to undergo hormone treatment



ENIAC (1945)

- First fully functioning electronic digital computer to be built in the U.S.
 - Electrical Numerical Integrator and Computer
 - University of Pennsylvania, for the Army Ordnance Department, by J. Presper Eckert and John Mauchly.
 - Far from general-purpose: The primary function was calculation of tables used in aiming artillery.
 - ENIAC was not a stored-program computer, and setting it up for a new job involved reconfiguring the machine by means of plugs and switches.
 - Used decimal digits instead of binary ones
 - Nearly 18,000 *vacuum tubes for switching*.
 - Storage of all those vacuum tubes and the machinery required to keep the cool took up over 167 square meters (1800 square feet) of floor space.
 - invented by American physicist Lee De Forest in 1906.
 - worked by using large amounts of electricity to heat a filament inside the tube. the presence of current represented a one.
 - punched-card input and output

John Von Neumann (1903-1957)



- von Neumann emphasized the importance of the ***stored-program concept*** for electronic computing, including the possibility of allowing the machine to modify its own program in useful ways while running
- Lead the ENIAC group towards an electronic stored-program general-purpose digital computer, the EDVAC
 - Von Neumann made the concept of a high-speed ***stored-program*** digital computer widely known through his writings and public addresses: '***von Neumann machines***'
 - von Neumann architecture: The separation of storage from the processing unit.
- Prolific scientist
 - Father of game theory, cellular automata, artificial life
 - Theoretical model of evolution
 - Cybernetics, Artificial Intelligence
 - See book: Aspray, William. 1990. *John von Neuman and the Origins of Modern Computing*. Cambridge, Mass.: MIT Press.

Semi-conductor Transistors

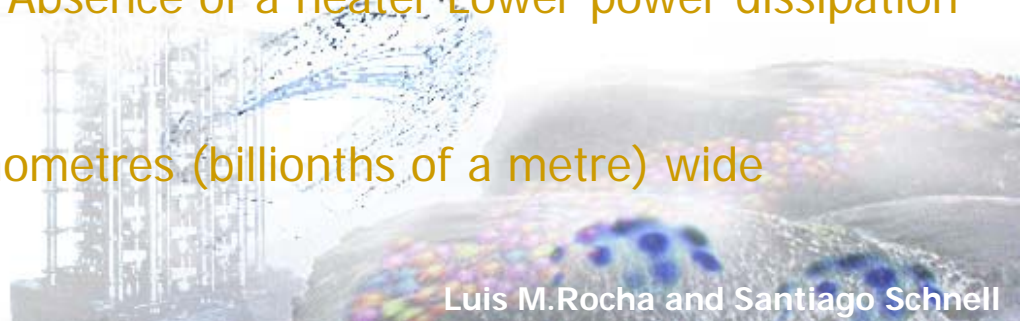
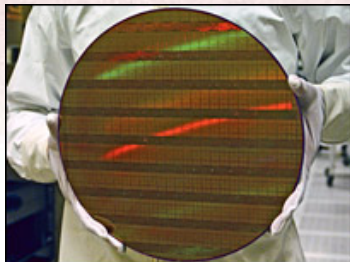
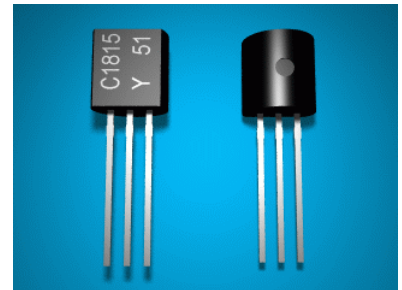
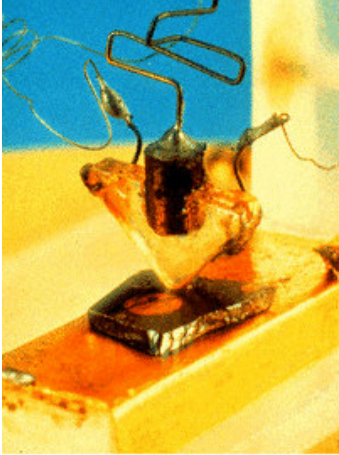
- Invented by John Bardeen, Walter Houser Brattain, and William Bradford Shockley
 - at Bell Laboratories in December 1947
 - awarded the Nobel Prize in physics in 1956.

Function as switches

- A device for making or breaking an electric circuit
 - Also for amplification in analog devices
- For choosing between several states
 - Between "on" and "off", "1" or "0"
 - Allows the construction of *logic gates*
- Semiconductor device
 - principally *silicon*, germanium and gallium arsenide.
- Better than vacuum tubes
 - Smaller size, Highly automated manufacture, Lower cost, Lower operating voltage, Absence of a heater Lower power dissipation etc.


Smallest Transistor

- Intel 2007: 45 nanometres (billionths of a metre) wide



Fun facts about Penryn: Intel's 45nm transistor

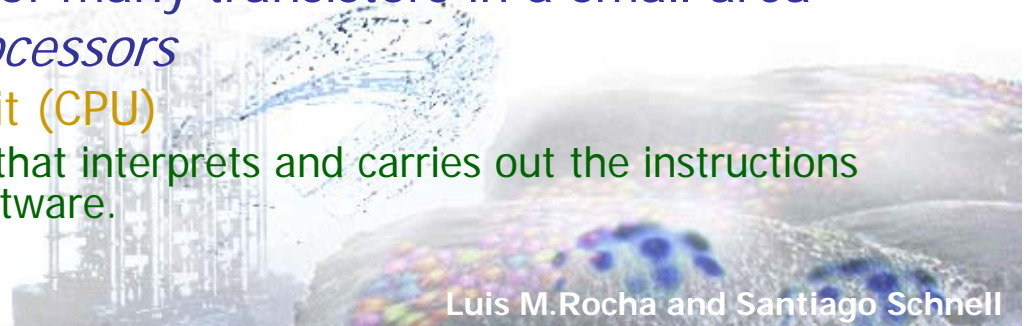
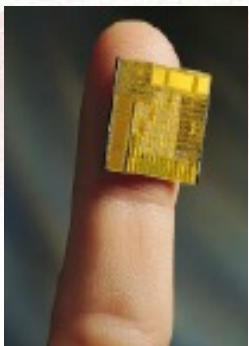
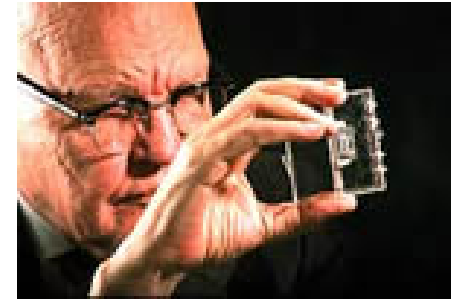
- 1 billion nanometers (nm) in one meter
 - A meter is approximately 3 feet.
- The 1947 original transistor could be held in your hand, while hundreds of Intel's new 45nm transistor can fit on the surface of a single red blood cell.
- If a house shrunk at the same pace transistors have, you would not be able to see a house without a microscope.
 - To see the 45nm transistor, you need a very advanced microscope.
- The price will be about 1 millionth the average price of a transistor in 1968. If car prices had fallen at the same rate, a new car today would cost about 1 cent.
- 2,000 fit across the width of a human hair.
- 30 million onto the head of a pin
- It can switch on and off approximately 300 billion times a second
 - A beam of light travels less than a tenth of an inch during the time it takes a 45nm transistor to switch on and off.



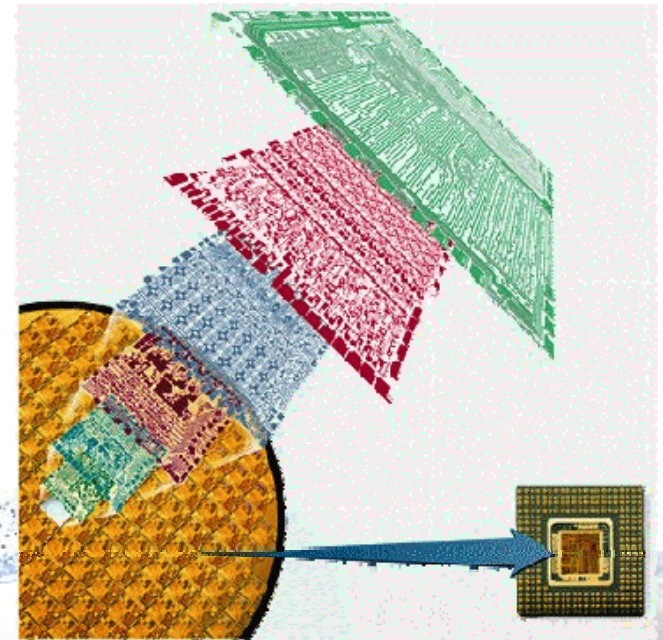
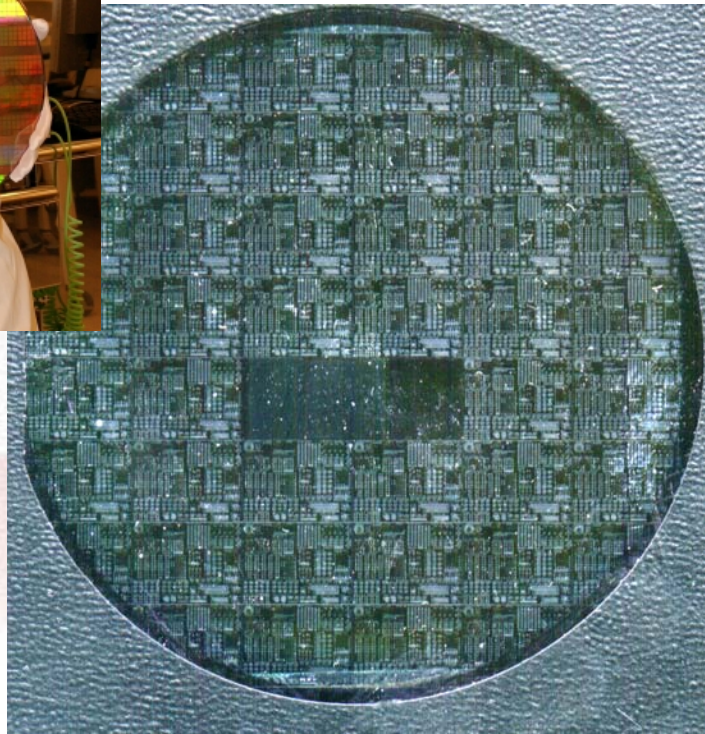
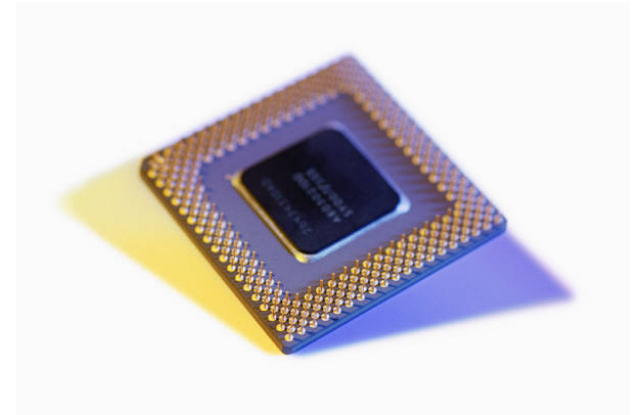
A nail = 20 million nm
A human hair = 90,000nm
Ragweed pollen = 20,000nm
Bacteria = 2,000nm
Intel 45nm transistor = 45nm
Rhinovirus = 20nm
Silicon atom = 0.24nm

Integrated Circuits

- First conceived Geoffrey W.A. Dummer
 - Royal Radar Establishment of the British Ministry of Defense in 1952.
- First manufactured independently by two scientists
 - Jack Kilby of Texas Instruments (Germanium) on February 6, 1958
 - Robert Noyce of Fairchild Semiconductor (Silicon) on April 25, 1961.
- Thin chip consisting of at least two interconnected semiconductor transistors, as well as passive components like resistors.
 - Modern-day chips are of size 1 cm² or smaller, and contain millions of interconnected devices.
 - Allowed the placement of many transistors in a small area
 - Typical use as *microprocessors*
 - Central Processing Unit (CPU)
 - part of a computer that interprets and carries out the instructions contained in the software.

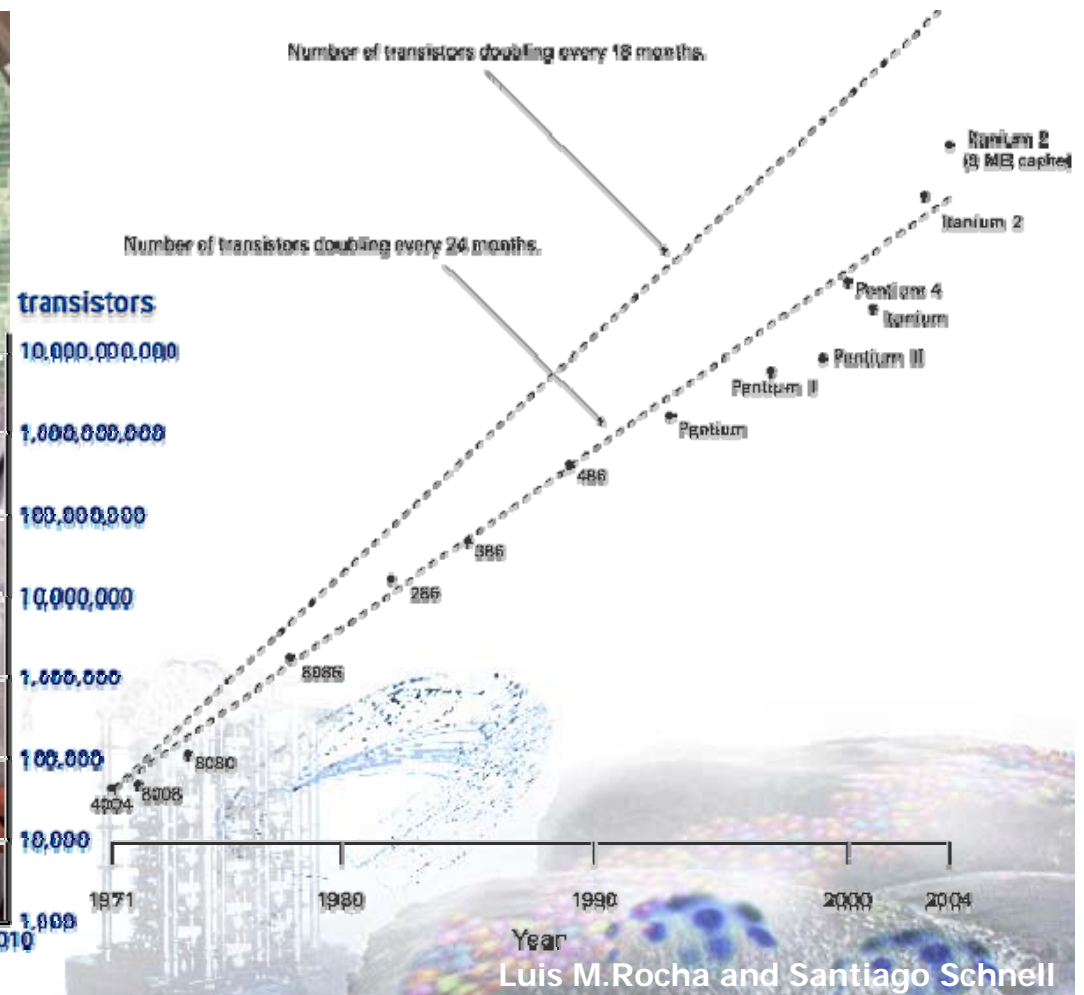
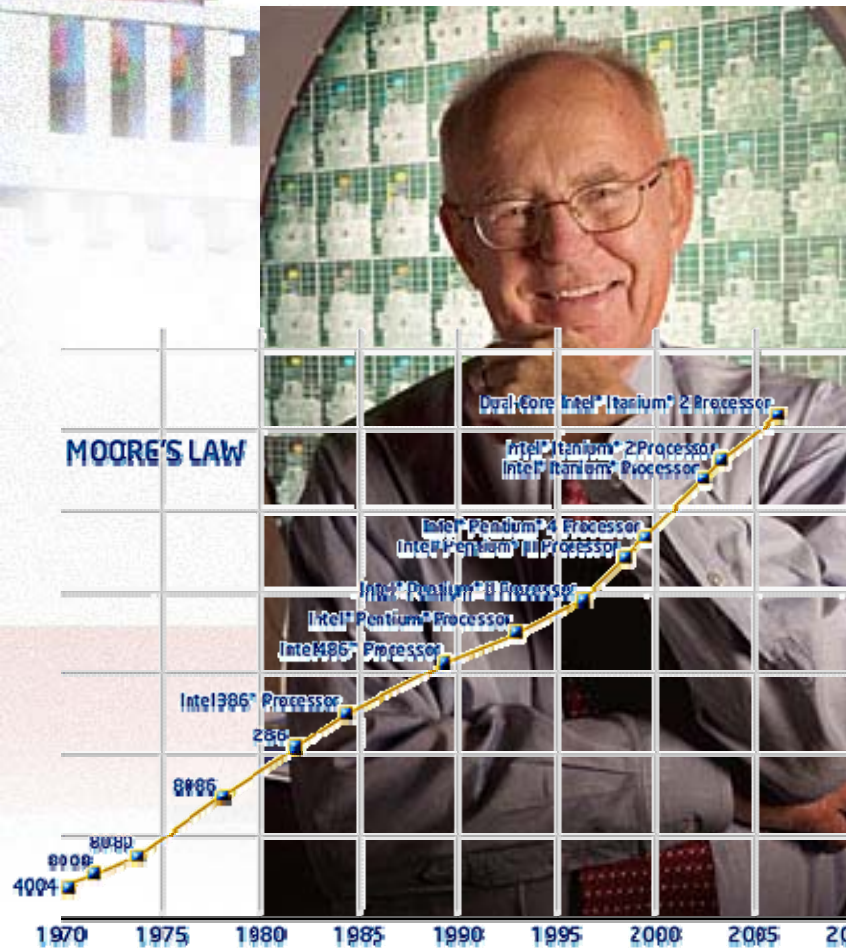
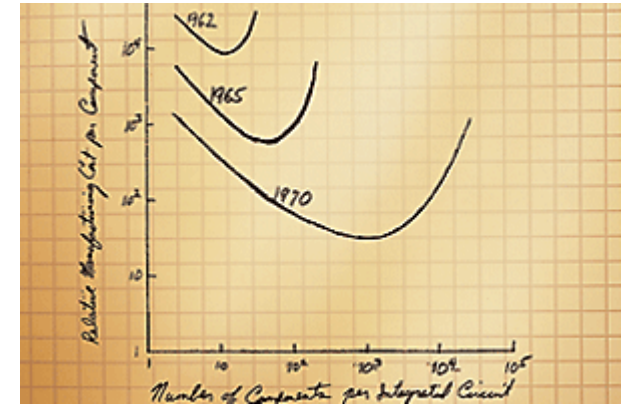


Integrated Circuits



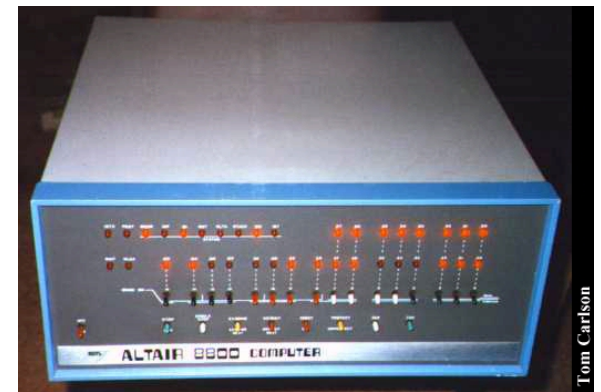
Moore's Law

- number of transistors on an integrated circuit for minimum component cost doubles every 24 months
 - density of transistors at which the cost per transistor is the lowest



The First Personal Computer

- In 1971, Intel released the first microprocessor.
 - Able to process four bits of data at a time!
- The Altair 8800 (1975)
 - by a company called *Micro Instrumentation and Telemetry Systems* (MITS) sold for \$397
 - Came as a kit for assembly who had to to write software for the machine
 - in machine code!
 - 256 byte memory --about the size of a paragraph
- Microsoft
 - Was born to create a BASIC compiler for the Altair
 - Beginners All-purpose Symbolic Instruction Code



PCs Galore!

Simplicity
is the
ultimate
sophistication.

■ Apple II (1977)

- Audio cassette interface
- BASIC programming language
- Display of 24 lines by 40 columns of upper-case-only text
- 4100 character memory
- \$1298.

■ TRS-80 (1977)

- Tandy Radio Shack
- 64,000 character memory
- disk drive to store programs and data on.

■ IBM (PC) 5150 (1981)

- modular design
- 16,000 character memory
- \$1265.



Introducing
Apple II,
the personal
computer.



Sinclair/Timex

- 1981-1982

- ZX81

- 8-16K

- Spectrum

- 48K



Luis M.Rocha and Santiago Schnell

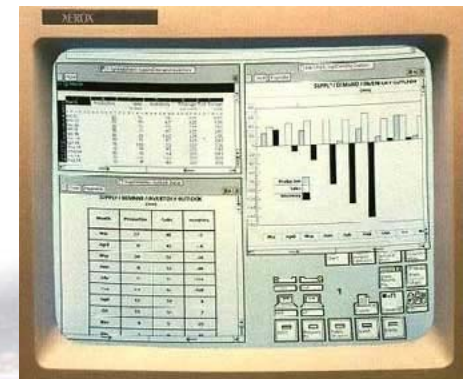
graphical user interface (GUI)

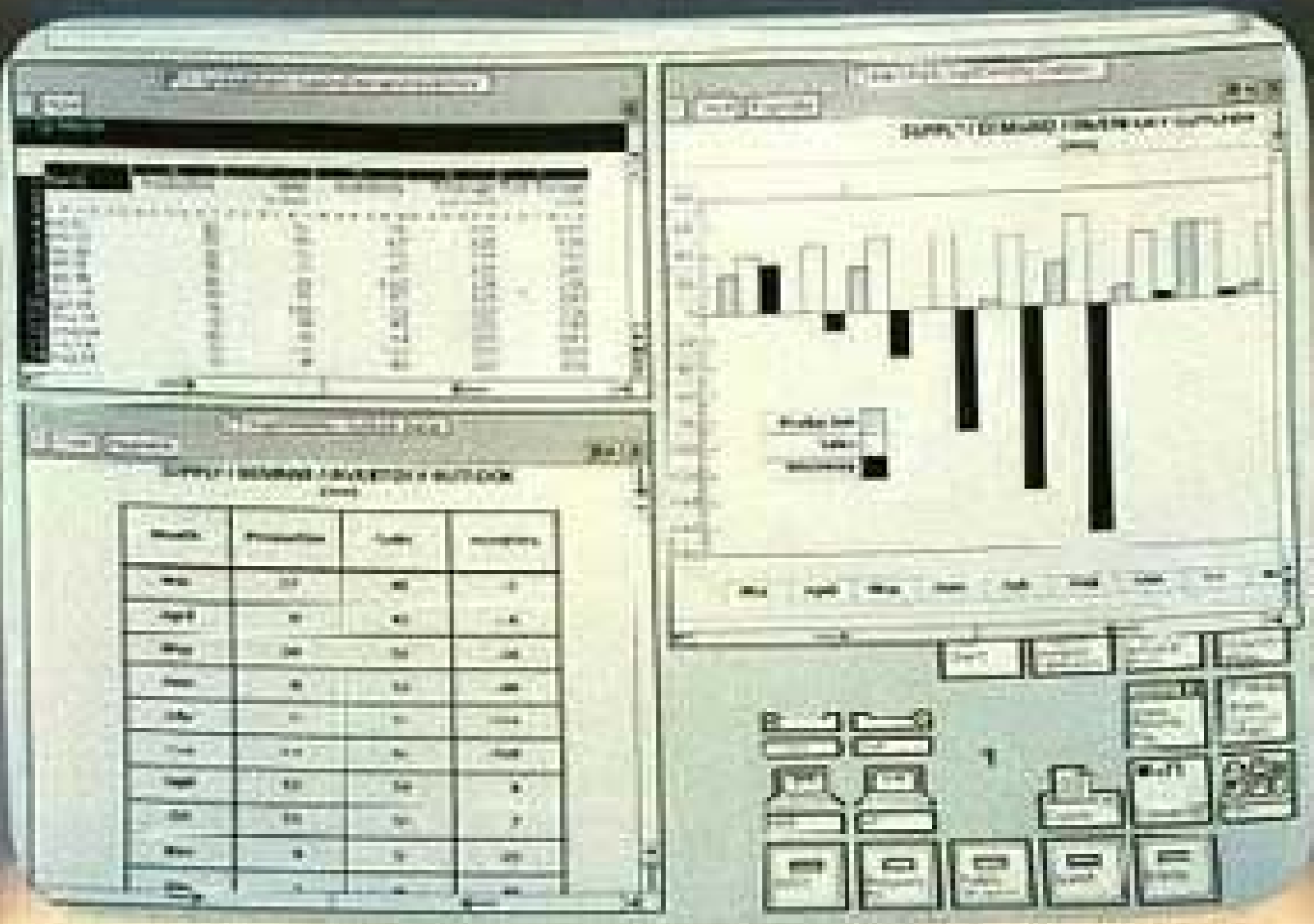
- On-Line System (NLS) (1960s)
 - Doug Engelbart's *Augmentation of Human Intellect* project @ Stanford Research Institute
 - pioneer of human-computer interaction
 - also developed *hypertext*
 - Incorporated a mouse-driven cursor and multiple windows.
 - WIMP (windows, icons, menus and pointers)
 - See his demo
 - <http://sloan.stanford.edu/MouseSite/1968Demo.html>



XEROX PARC

- Xerox Alto (1973)
 - first computer to use the *desktop metaphor* and GUI





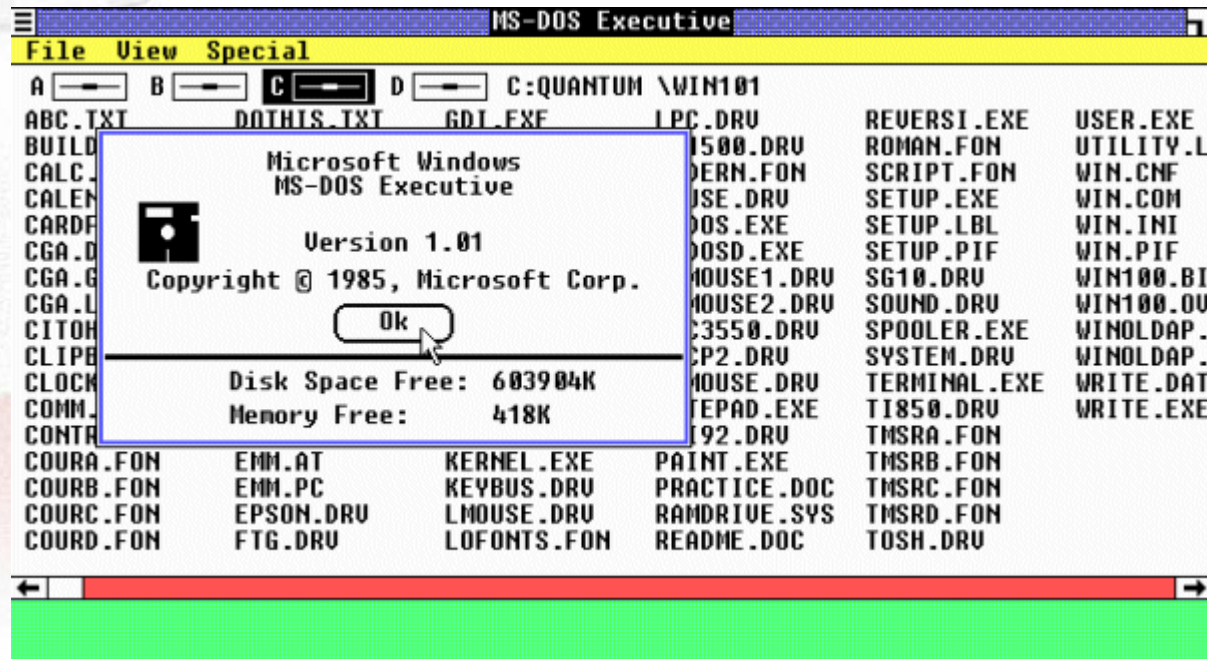
graphical user interface (GUI)

- **Macintosh (1984)**
 - Steve Jobs adapted the idea from Xerox PARC
 - Introduced with a famous super bowl commercial \$2,495
 - <http://www.uriah.com/apple-qt/1984.html>
 - Directed by Ridley Scott (Blade Runner)
 - **Characteristics**
 - graphical user interface, icons, a desktop, etc.
 - The use of a mouse or other pointing device in personal computing
 - The "double click" and "click-and-drag" behaviors to perform actions with a pointing device



Microsoft Windows

- Windows 1.0 (1985)
 - Running on MS-DOS (operative system)
 - http://www.infosatellite.com/news/2001/10/a251001windowshistory_screenshots.html



From the PC to Information Factories

Google Gmail Calendar more >

@gmail.com | Settings | Help | Sign out

Google
Calendar BETA

Create Event

Quick Add

< April 2006

M	Tu	W	Th	F	Sa	Su
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
1	2	3	4	5	6	7
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Calendars

My Calendars +

Matt Cutts

Matt @

Conferences

Other Calendars +

Search public calendars

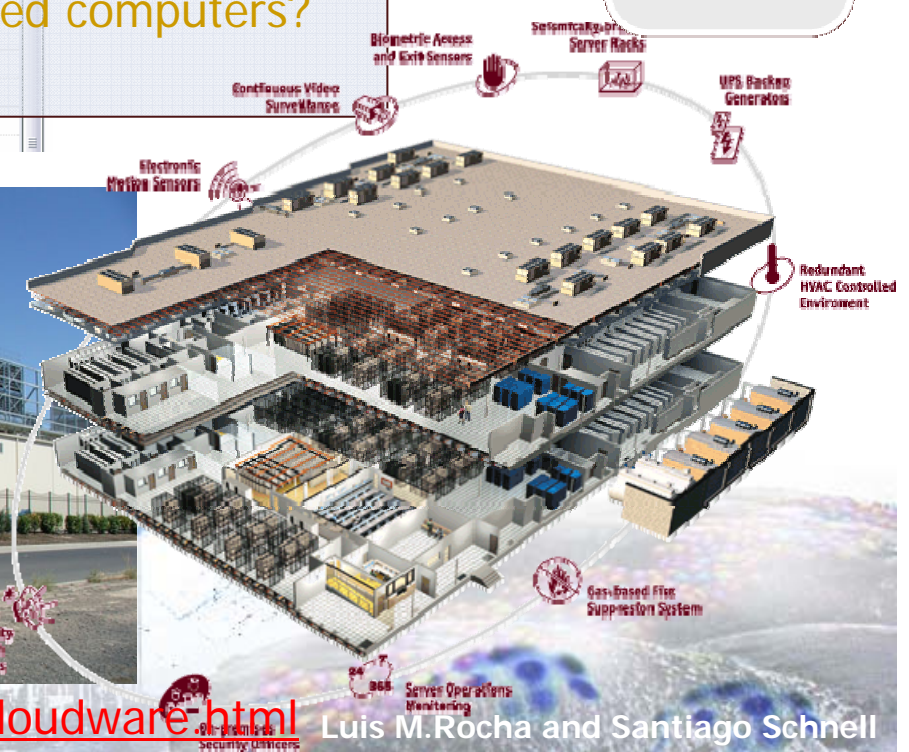
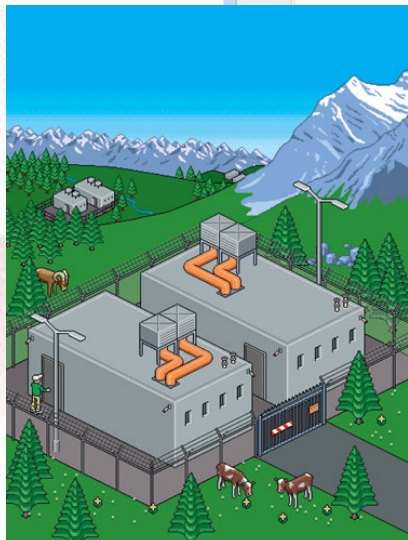
Manage calendars

The Internet Cloud

- Bulk of computing and storage moving to Information Factories
- Huge centralized computers comprised of tens of thousands of servers
 - Server Farms
- Is the desktop dead?
 - A future with decentralized computers?
 - Peer to Peer Networks?

Google
Docs & Spreadsheets BETA

fauXto™
image editing en masse



<http://www.wired.com/wired/archive/14.10/cloudware.html>

Luis M. Rocha and Santiago Schnell

Possible Exam Questions

- What is informatics?
- What is the difference between an “index” and an “symbol”?
- Examples of Analogue vs. Digital Information?
- How does Information Technology relate to semiotics?
- Transparent vs Opaque Technology?
- Describe two computing devices used before the XX century.
- What is a GUI?

Which computer first featured the mouse and the desktop metaphor GUI?





Next Class!

- Topics
 - Modeling the World
 - Individual Assignment
- Readings for Next week
 - Lecture notes Posted online @ <http://informatics.indiana.edu/rocha/i101>
 - *Modeling the World*
 - @ *infoport*
 - From course package
 - From Andy Clark's book "*Natural-Born Cyborgs*"
 - Chapter 6: Global Swarming (pp. 45-67)
- Lab 4
 - More HTML and CSS