Computer Fundamentals

Lecture # 2:

Introduction to Computer & History (Continued)

http://groups.yahoo.com/neo/groups/cf_fall2011/info

Today's Aim

- Vacuum Tubes; Electronics arrived
- Advent of Transistors
- IC's
- Microprocessor – The on-chip processor
- Microcomputer

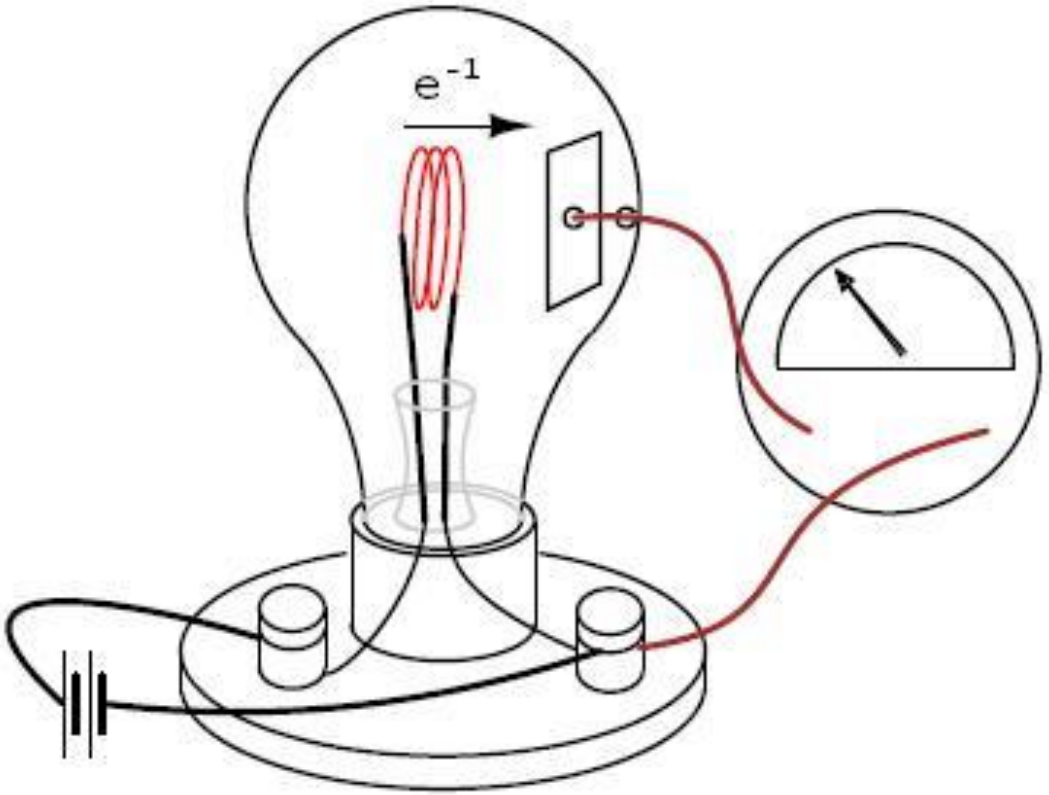
History (Vacuum Tubes)

- Vacuum Tubes (Thermo-ionic Valves)
  - The very first Electronic Devices because they provided ‘electrically Controlled Current’ & ‘Controlled Voltage’
  - But switches and rheostats etc. also control electricity!
  - The special thing about is that *“electricity controls electricity”*

History (Vacuum Tubes)

- Edison Effect
  - Thomas Edison, in 1880, while developing the incandescent lamp, observed that *“a small current passed from the **heated filament** to a **metal plate** mounted inside the vacuum envelop*
  - Electrons would flow from the filament to the metal plate even if the filament was heated by some other means, battery is not mandatory

History (Vacuum Tubes)

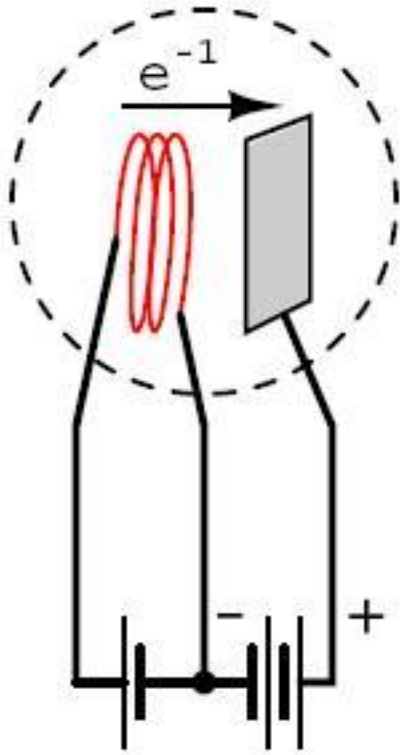


Edison Effect

History (Vacuum Tubes)

- Flemming Valve (Vacuum Diode)
  - By 1904, John Flemming, the advisor of Marconi Wireless Company found that *“an externally applied current only passed in one direction i.e., from the filament to plate but not the reverse direction”*
  - This invention was called ‘the vacuum diode’ and was used to convert AC into DC

History (Vacuum Tubes)

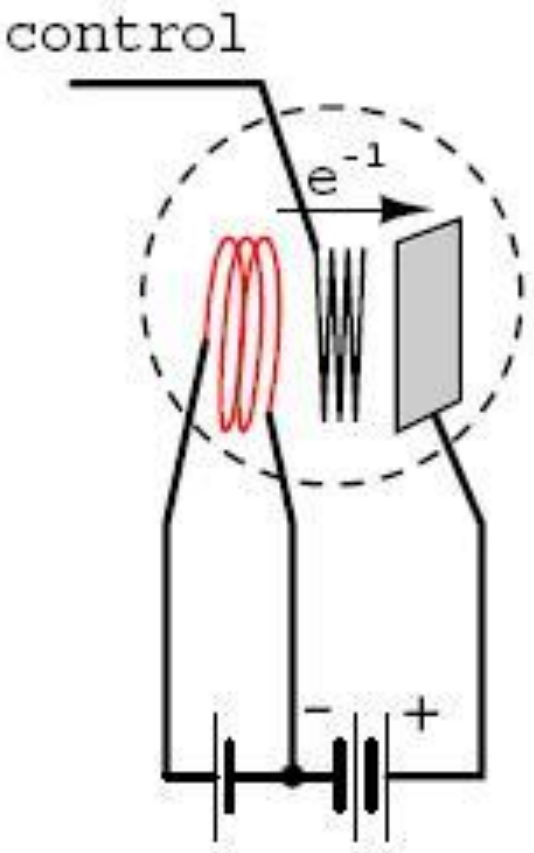


Flemming valve

History (Vacuum Tubes)

- These were two initial steps towards electronics
- The era of electronics began with the invention of the *Audion tube,* when Lee DeForest added a third electrode to the vacuum diode; that allowed a small signal to control the larger electron flow from filament to plate
- This device truly provided *electrical control of electricity*

History (Vacuum Tubes)



DeForest Audion triode vacuum tube amplifier

History (Vacuum Tubes)

- Drawbacks of Vacuum Tubes
  - Large Glass Tubes
  - Power Hungry
  - Computers using them (e.g., Colossus, ENIAC, Manchester Small-Scale Experimental Machine, EDSAC, Manchester Mark 1) were large enough to occupy big halls

History (Transistors)

- Advent of Transistors
  - Computers using vacuum tubes as their electronic elements were in use throughout the 1950s
  - But by the 1960s had been largely replaced by transistor-based machines
  - smaller, faster, cheaper to produce, require less power and more reliable.
  - The first transistorized computer was demonstrated at the University of Manchester in 1953

History (ICs)

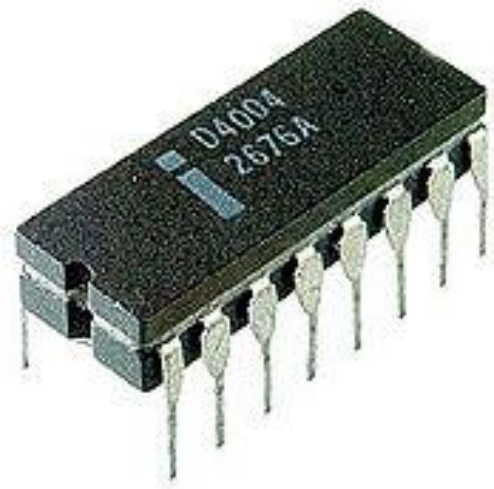
- Late 1960s - Integrated Circuits
- 1971, Intel's DRAM and EPROM
  - 4001; 256 Byte ROM with a 4-bit I/O port
  - 4002; 40 Byte RAM (80x4) with a 4-bit I/O port
  - 4003; 10-bit parallel output '*shift register*' for scanning keyboards, displays, printers, etc

History (microprocessors)

- Intel 4004
  - The first complete CPU on a single chip
  - Produced from late 1971 to 1981
  - Released on November 15, 1971
  - New silicon technology at that time, higher speed and Integration, executed approximately 92,000 instructions per second
  - Maximum Clock Speed 740 kHz
  - Separate program and data storage (i.e., a Harvard architecture)

History (microprocessors)

- Intel 4004 (continued)
  - 12-bit addresses
  - 8-bit instructions
  - 4-bit *'data words'*
  - *'Instruction set'* contains 46 instructions
  - Register set contains 16 registers of 4 bits each



16 bit ceramic Dual-inline Package

History (microprocessors)

- Successors of Intel 4004 (pre x86)
  - Intel 4040
  - Intel 8008
  - Intel 8080
  - Intel 8085
- X86-16 (16-bit) series
  - Intel 8086
  - Intel 8088
  - Intel 80186
  - Intel 80188
  - Intel 80286

History (microcomputer)

- Altair 8800 (1975)
  - A microcomputer; product of MITS *(Micro Instrumentations & Telemetry System),* founded by ‘Ed Robert, Forrest M. Mims, Stan Cagle & Robert Zaller in 1969.
  - Based on Intel 8080 CPU, an 8-bit microprocessor
  - Was expected to be sold in hundreds but thousands were sold in the first month
  - the first programming language for the machine was Altair BASIC, by Microsoft

History (microcomputer)

- TRS-80 (The Model I)
  - Released in 1977 by Tandy Corporation
  - *Apple and Commodore were major competetors*
  - It combined the mainboard and keyboard into one unit
  - It used a *Zilog Z80* processor clocked at 1.77 MHz
  - Popular with the hobbyists and small-scale businesses
  - More than 250,000 were sold, discontinued in 1981

History (microcomputer)

- Model II
  - In October 1979, Tandy Corporation began shipping the *Model II*
  - It was not an upgrade of the Model I, but an entirely different system, built using the faster Zilog Z80A chip running at 4 MHz
  - The Model II ran the TRSDOS-II operating system which was not compatible with TRSDOS for the Model I
  - Thus Model II never had the same breadth of available software as the Model I

History (microcomputers)

- Successors to TRS-80 (Model I)
  - Major drawback of Model I was the massive RF interference it caused in surrounding electronics, thus violating FCC (Federal Communication commission) regulations
  - This drawback was removed with the release of **Model III** in July 1980
  - This machine was much more integrated and used a much faster (2.08 MHz) Z-80 processor
  - The successor to the Model III was the **Model 4** (April 1983)

History (microcomputers)

- IBM PC
  - **IBM PC**, is the original version and progenitor of the *IBM PC compatible* hardware platform
  - Introduced on August 12, 1981; used *Intel 8088* operating at *4.77 MHz*
  - Came into the market to compete *Commodore PET, Atari 8-bit family, Apple II* and *Tandy Corporation's TRS-80s*
  - Unlike its competitors, It was specifically designed for professional and scientific problem-solvers, not meant just for hobbyists

History (microcomputer)

- IBM PC
  - Gained popularity because;
  - ‘off-the-shelf’ components were used to reduce cost
  - Open architecture was followed so that, other manufacturers could produce and sell peripheral components and compatible software without purchasing licenses
  - IBM also sold an *IBM PC Technical Reference Manual* which included complete circuit schematics, a listing of the ‘ROM BIOS source code’

History (microcomputers)

- Hence *Columbia Data Products* introduced the first IBM-PC compatible computer in June 1982
- In November 1982, *Compaq Computer Corporation* announced the *Compaq Portable*, the first portable IBM PC compatible
- The "IBM Personal Computer XT", IBM's model 5160; enhanced for business use

History (microcomputers)

- The "IBM Personal Computer/AT", announced August 1984
- Used an Intel 80286 processor, originally running at 6 MHz
- It had a 16-bit ISA bus and 20 MB hard drive
- A faster model, running at 8 MHz, was introduced in 1986
- IBM Convertible, IBM Portable & PCjr are other models in this line

History (microprocessors)

- Pentium
  - A 32-bit microprocessor produced by Intel.
  - The first large-scale x86 architecture processor
  - Introduced on March 22, 1993
  - Its micro-architecture was called ‘P5’, *(pent means ‘five’ in Greek)*

History (microprocessors)

- Pentium
  - P5
  - The original Pentium Processor was code named ‘P5’
  - It operated at 60 MHz and 66 MHz
  - It contained 3.1 million transistors
  - Measured 16.7 mm by 17.6 mm for an area of 293.92 mm^2
  - Fabricated in a 0.8 µm BiCMOS process

History (microprocessors)

- Pentium
  - P54C
  - The P5 was followed by the P54C (80502)
  - Operated at 75, 90 and 100 MHz
  - It contained 3.3 million transistors
  - Measured 163 mm^2
  - Fabricated in a 0.6 µm BiCMOS process.

History (microprocessors)

- Pentium
  - P54CQS
  - The P54C was followed by the P54CQS
  - Operated at 120 MHz
  - The first commercial microprocessor to be fabricated in a 0.35 µm BiCMOS process
  - It had the same area as P54C, to fit into the existing pad-ring
  - Only the logic circuitry was reduced to achieve higher clock speed

History (microprocessors)

- Pentium
  - P54CS
  - The P54CQS was followed by the P54CS
  - Operated at 133, 150, 166 and 200 MHz
  - It contained 3.3 million transistors
  - Measured 90 mm^2
  - Fabricated in a 0.35 µm BiCMOS process with

History (microprocessors)

- Successors of Pentium
  - x86-32 / IA-32 (32 bit)
  - Pentium Pro, Pentium II, Pentium III, Pentium 4, Pentium M, Celeron M, Celeron D & Intel A100
  - x86-64 (64 bit)
  - Pentium 4 (Some), Pentium D, Pentium Extreme Edition & Celeron D (Some)

History (microprocessors)

- Successors of Pentium
  - Current
  - Atom, Celeron, Pentium Dual-Core, Core 2, Core i3, Core i5, Core i7, Xeon and Itanium
  - Upcoming
  - Moorestown, Core i9