

# Computer Architecture

*General Notes - History*

# Charles Babbage

## Early 19th Century

- ...wanted to eliminate the operator on his loom and still perform a series of operations in a predetermined sequence. Babbage was held back by the technology of his time. He never completed his project, but he did establish the basic principles of which computers are now built. A few years ago, a group tried to build Babbage's loom using his plans. They discovered he did have the correct idea, his model did work. He is remembered for another first great success. He was first to receive government support toward technology.

# Herman Hollerith

## Late 19th Century

- Hollerith processed data on punched cards for census applications. His machine cut the population counting from 7.5 years to only 6 weeks. His invention allowed him to start a company called the Tabulating Machine Company. That company eventually became the International Business Machines Corporation (IBM).

# Howard Aiken, Early 20th Century

- Aiken used punched cards on a machine that used a combination of electromechanical device, including relays. His success led to many tables of mathematical functions. The machine was amazing but very slow.

# S. P. Eckert & J. W. Mauchly, Mid 20th Century

- These men helped to develop the ENIAC, the first electronic computer. It used vacuum tubes, switches and control boards. Later, the ENIAC was further developed into EDVAC which had its program stored in the computers memory.
- By the late 1950's, the transistor began to replace the vacuum tube in computers. They were much smaller, faster, and more reliable.

In the 1960's, the integrated circuit was  
developed.  
The rest is history...

# John Von Neumann

## Mid 20th Century

- Von Neuman also worked on EDVAC. He is often given credit for the stored program concept.
- Without the stored program, each command had to be entered by hand.

# The Von Neumann Machine

- The structure of EDVAC established the organization of the stored - program computer (von Neumann machine), which contains:
- An input device through which data and instructions can be entered.
- A storage into which results can be entered and from which instructions can be fetched.

# The Von Neumann Machine

- An arithmetic unit to process data.
  - A control unit to fetch, interpret, and execute the instructions from the storage.
  - An output device to deliver the results to the user.
- All contemporary computers are von Neumann machines, although various alternative architectures are being investigated.

# Computers and Communication

- Bob Bemer, at IBM, foresaw eventual computer involvement in communication. In 1960 July he described a communication method using computers at both ends, the originator compressing the text, the receiver reconstituting it. Bemer headed a group of programmers devising languages by which machines can talk with machines - languages that will facilitate the exchange of information, by radio, microwave, or telephone wire between computers at widely separated centers. Bob Bemer was a major force in the creation of ASCII:

# Computers and communication

- He published a survey, of over 60 different computer codes in use, which raised awareness of need and triggered a common effort.
- forcing the U.S. standard code to be identical to the international,
- making the major proposals for its content and form  
conceiving and proposing formal registry of ASCII-  
alternate symbol and control sets to permit interchange of  
all of the world's characters

# Generations of Computers: The hardware point of view!

1. Vacuum tube technology. 1950's.
2. Transistor technology. Late 50's, early 60's.
3. Integrated circuit technology. Mid 60's, 70's. IC's to large-scale integration (LSI).

# Generations of Computers: The hardware point of view!

4. 4th: Very large-scale integration (VLSI).  
Microprocessors are as powerful as the  
microprocessors of the 70's.
5. Next: There is no accepted definition yet?

Using past knowledge and taking advantage of the today's advances.

1. Networks use several computers to share the processing load. Distributed processing where the processors work together yet separately.
2. Architecture that breaks the problem into parallel processing tasks.
3. Variations using instructions (RISC. CISC).
4. etc.....

# What is going on now?

- Computers with high computational ability.
- Computers with large memory capacity.
- Computers with multiple processors that are flexible.
- Artificial-intelligence-based machines with user-friendly natural interfaces.
- No computer without a network
- Everything seems to be changing.

# Why Computer Architecture?

- Students receive a basic understanding of how the lowest level activities in a machine are performed.
- Students see how the low level and the higher levels are connected.
- “..a fair understanding of the operating principles, capabilities, and limitations of digital computers is necessary, if we wish to use them in an efficient manner.” (Shiva, 1991)
- As educators, we need to understand the whole machine, its history and understand its future.

# What is Computer Architecture?

- Deals with hardware design of computer systems and the basic hardware building blocks from which computers are constructed.
- Helps users to develop the function and performance specifications of various computer systems.
- Is required to consult with software designers and hardware vendors.

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