

CHAPTER 2

COMPUTER EVOLUTION



THE FIRST GENERATION — 1946 -1957

- Vacuum Tubes



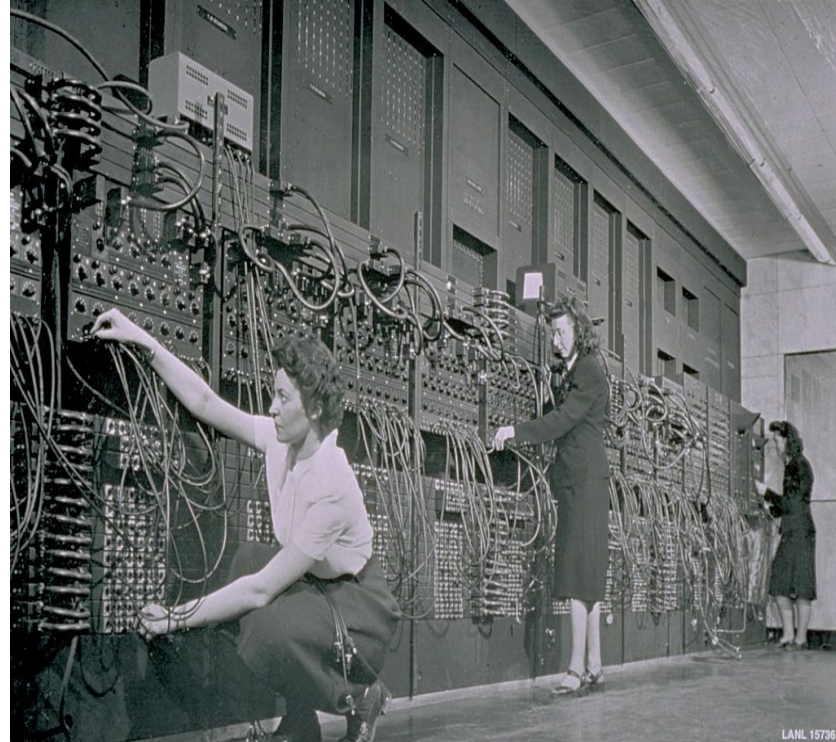
ENIAC - BACKGROUND

- Electronic Numerical Integrator And Computer
- Eckert and Mauchly
- University of Pennsylvania
- **Trajectory tables** for weapons
- Started 1943
- Finished 1946
 - Too late for war effort
- Used until 1955
 - to help determine the **feasibility of the hydrogen bomb**



ENIAC - DETAILS

- **Decimal** (not binary)
- 20 accumulators of 10 digits
- 18,000 **vacuum tubes**
- 30 tons
- 15,000 square feet
- 140 kW power consumption
- **5,000 additions** per second
- **Programmed manually by switches**
- It took days to rewire the machine for each new problem.

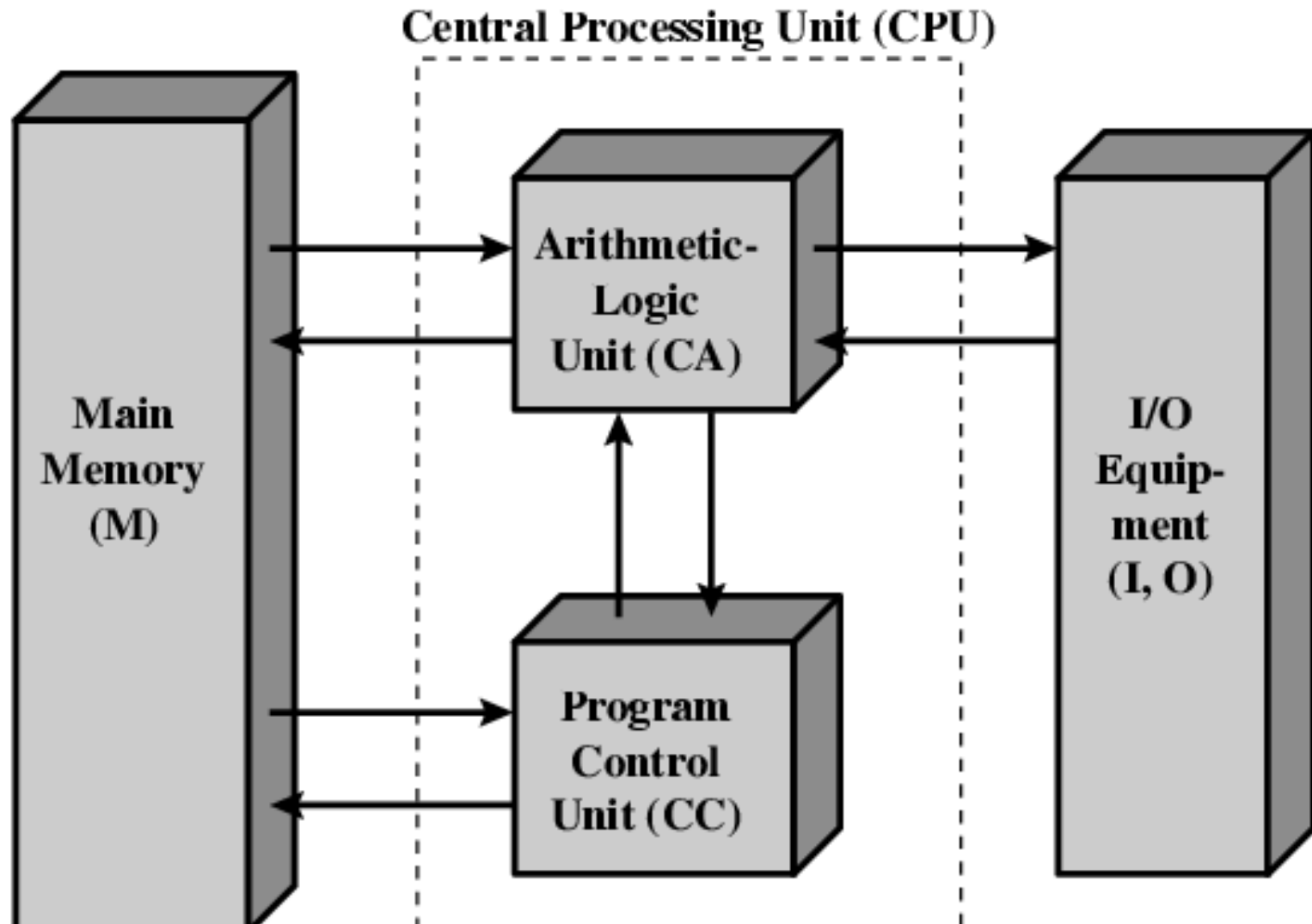


VON NEUMANN/TURING

- **Stored Program concept**
- **Main memory** storing **programs** and **data**
- **ALU** operating on **binary data**
- **Control unit interpreting** instructions from memory and **executing**
- **Input** and **output** equipment operated by **control unit**
- Princeton Institute for Advanced Studies
 - **IAS**
- Completed 1952



STRUCTURE OF VON NEUMANN MACHINE

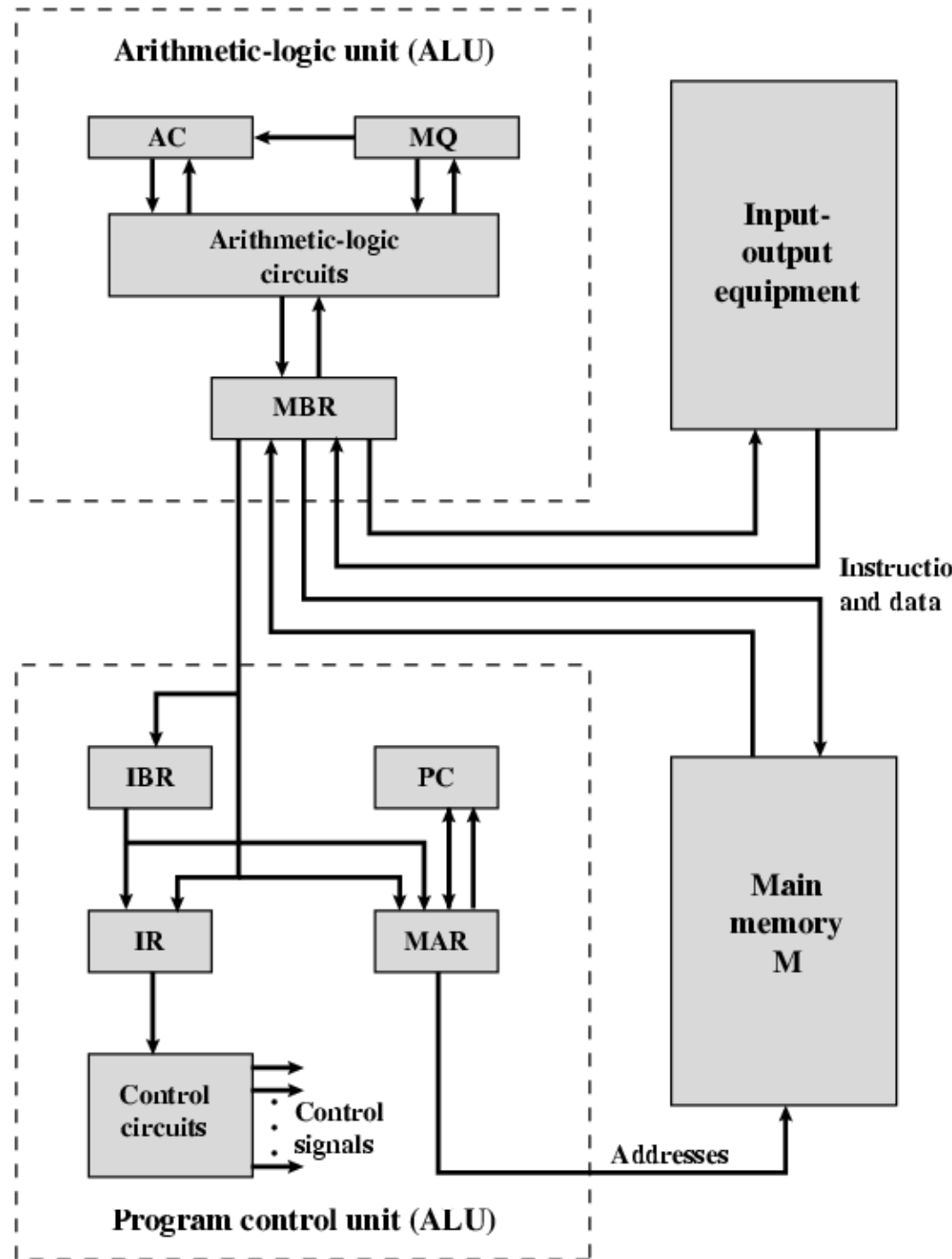


IAS - DETAILS

- 1000 storage locations called Words
- Word length - 40 bit words
 - Binary number
- Set of registers (**storage in CPU**)
 - **Memory Buffer Register:**
 - contain the **word** to be stored in **memory** or just received from **memory**
 - **Memory Address Register**
 - Specifies the address in **memory** of the **word** to be **stored** or **retrieved**
 - **Instruction Register**
 - Contains the 8 bit **opcode** currently being **executed**
 - **Instruction Buffer Register**
 - **Temporary store** for RHS instruction from **word** in **memory**
 - **Program Counter**
 - **Stores the address** of the **next instruction** to fetch from memory
 - **Accumulator/ Multiplier Quotient**
 - Holds **operands** and **results** of ALU ops



STRUCTURE OF IAS - DETAIL



COMMERCIAL COMPUTERS

- 1947 - Eckert-Mauchly Computer Corporation
- UNIVAC I (Universal Automatic Computer)
 - US Bureau of Census 1950 calculations
- Late 1950s - UNIVAC II
 - Faster
 - More memory



IBM

- Punched-card processing equipment
- 1953 - the 701
 - IBM's first stored program computer
 - Scientific calculations
- 1955 - the 702
 - Business applications
- Lead to 700/7000 series

Punch Card in
Punch Card Machine



ComputerHope.com



FIRST GEN. COMPUTERS

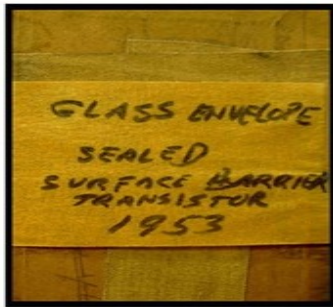
- » The computers were very large in size.
- » They consumed a large amount of energy.
- » They heated very soon due to thousands of vacuum tubes.
- » They were not very reliable.
- » Air conditioning was required.
- » Constant maintenance was required.
- » Non-portable.
- » Costly commercial production.
- » Limited commercial use.
- » Very slow speed - milliseconds.
- » Limited programming capabilities.
- » Used machine language only.
- » Used magnetic drums which provide very less data storage.



SECOND GENERATION COMPUTERS

1958-1964

1953 "Experimental" Philco Surface Barrier Transistor



Original hand-written description
information on outside of tube box



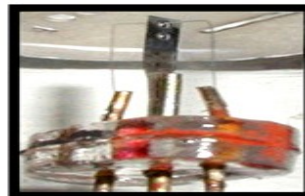
"Experimental" Transistor



Philco Marked



Production Model
Actual Size



Close-Up View
Surface Barrier Transistor



Production Model
Enlarged View



TRANSISTORS

- Replaced vacuum tubes
- Smaller
- Cheaper
- Less heat dissipation
- Solid State device
- Made from Silicon (Sand)
- Invented 1947 at Bell Labs
- William Shockley et al.



TRANSISTOR BASED COMPUTERS

- Second generation machines
- NCR & RCA produced small transistor machines
- IBM 7000
- DEC - 1957
 - Produced PDP-1



SECOND GENERATION

▪ Advantages

- » Smaller in size compared to the first generation of computer.
- » The second generations computers were more reliable.
- » Used less energy and were not heated as much as the first one.
- » Better speed and could calculate data in microseconds.
- » Used faster peripherals.
- » Better portability as compared to the first generation.
- » Accuracy improved.
- » Used assembly language as well.



SECOND GENERATION

Disadvantages

- Discrete components
 - Manufacturing 10,000 transistors separately – difficult -> 3rd Gen.
- Cooling system was required.
- Only used for specific purposes
- Constant maintenance was required
- Commercial production was difficult
- Costly and not versatile
- Punched cards were used for input.



THE THIRD GENERATION: INTEGRATED CIRCUITS — 1965-



MICROELECTRONICS

- Literally - “small electronics”
- The invention of the integrated circuit
- A computer is made up of gates, memory cells and interconnections
- These can be manufactured on a semiconductor
- Many transistors can be produced at the same time on a single wafer of silicon
- e.g. silicon wafer
- *Generation of computer got blurry*



GENERATIONS OF COMPUTER

- Vacuum tube - 1946-1957
- Transistor - 1958-1964
- Small scale integration - 1965 on
 - Up to 100 devices on a chip
- Medium scale integration - to 1971
 - 100-3,000 devices on a chip
- Large scale integration - 1971-1977
 - 3,000 - 100,000 devices on a chip
- Very large scale integration - 1978 -1991
 - 100,000 - 100,000,000 devices on a chip
- Ultra large scale integration – 1991 -
 - Over 100,000,000 devices on a chip



MOORE'S LAW

- Gordon Moore – co-founder of Intel
- Number of transistors on a chip will double every year
- Since 1970's development has slowed a little
 - Number of transistors doubles every 18 months
- Cost of a chip has remained almost unchanged
- Higher packing density means shorter electrical paths, giving higher performance
- Smaller size gives increased flexibility
- Reduced power and cooling requirements
- Fewer interconnections increases reliability

