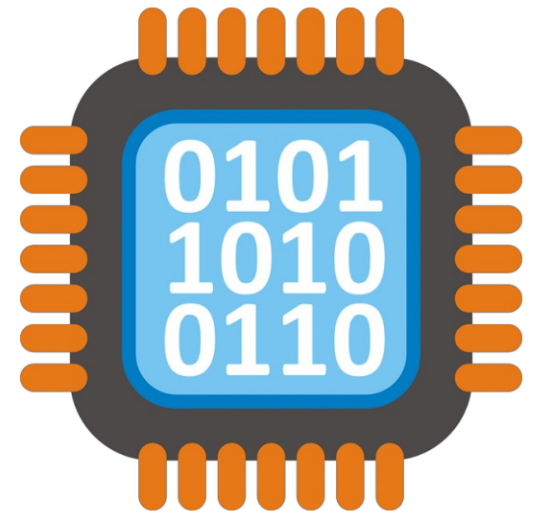


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Secure Assembly Coding

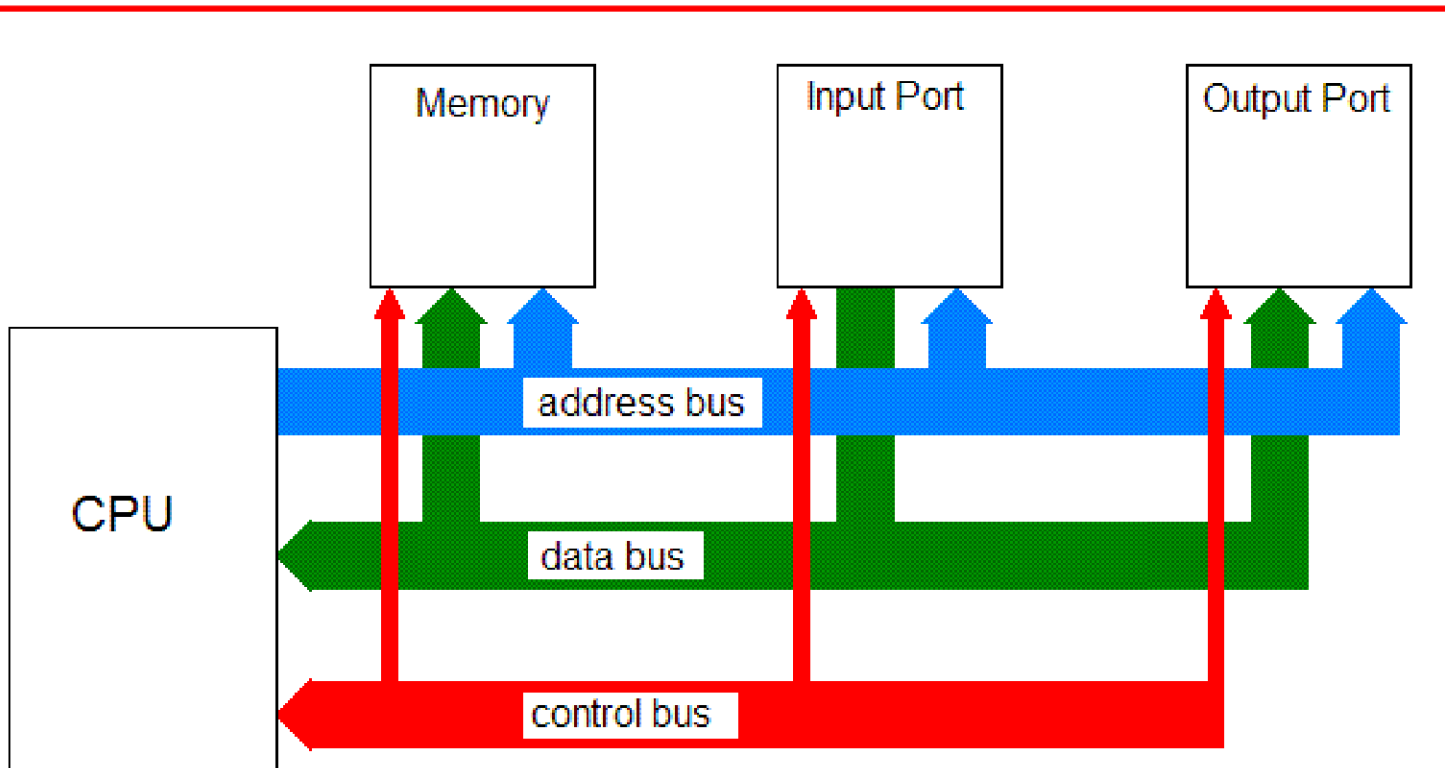
Week # 2 Lectures

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Department of Cybersecurity

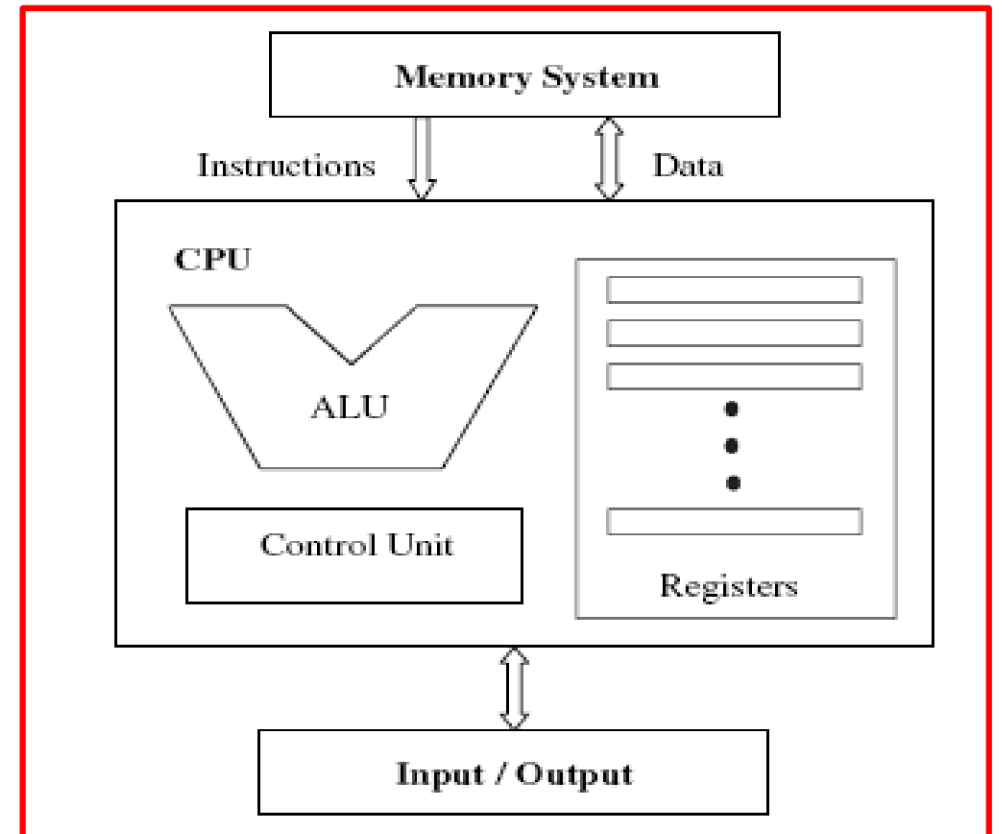


What is a Computer?

- Programmable machine that receives input, stores and manipulates data, and provides output in a useful format.
- Basic computer system consists of: Microprocessor (CPU), Memory (RAM and ROM), Input/output (I/O) units, and System Bus (D, A, C).



Seure Assembly Coding_Dr. Q.A. Al-Haija



What is a Microprocessor (μ P)?

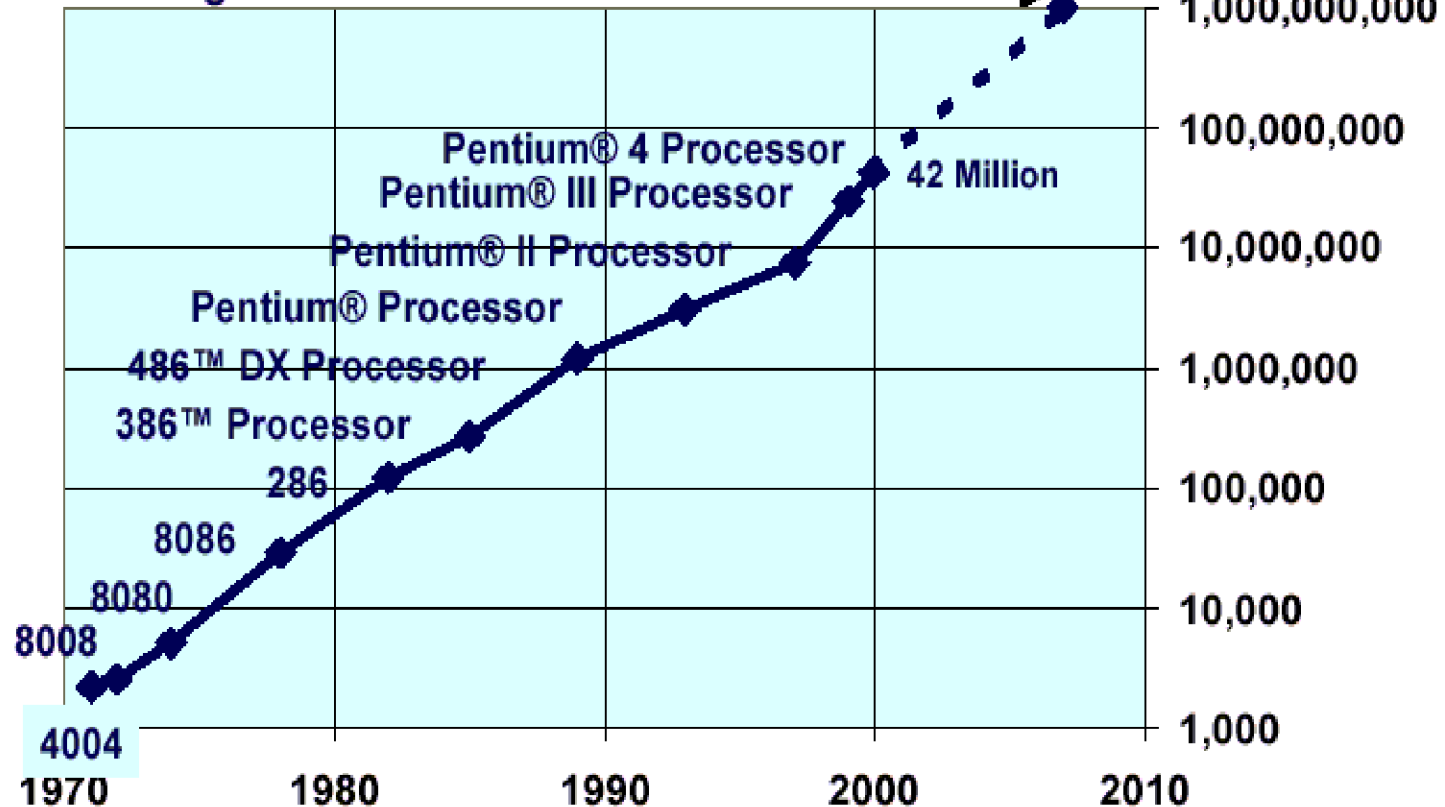
- A processor is built from a large number of integrated circuits.
- A microprocessor is a processor packaged as a single IC chip.
- A microcomputer is a computer that uses a microprocessor as its CPU.
- 8-bit or 16-bit μ P: refers to number of bits manipulated in one operation.
- It requires external memory to execute programs.
- It cannot directly interface to I/O devices \rightarrow peripheral chips are needed.
- Examples of μ P is Intel 8085 (8-bit μ P) and Intel 8086 (16-bit μ P).
- μ Ps mainly use: [Fetch-Execute](#) Cycles to run the programs (Codes).

Evolution of Microprocessor

Moore's Law Continues

Transistors doubling every 2 years toward the billion-transistor microprocessor

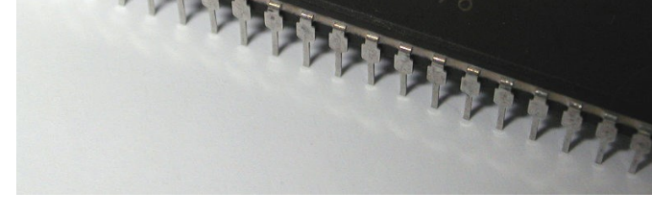
Heading toward 1 billion transistors in 2007



HISTORICAL PERSPECTIVE

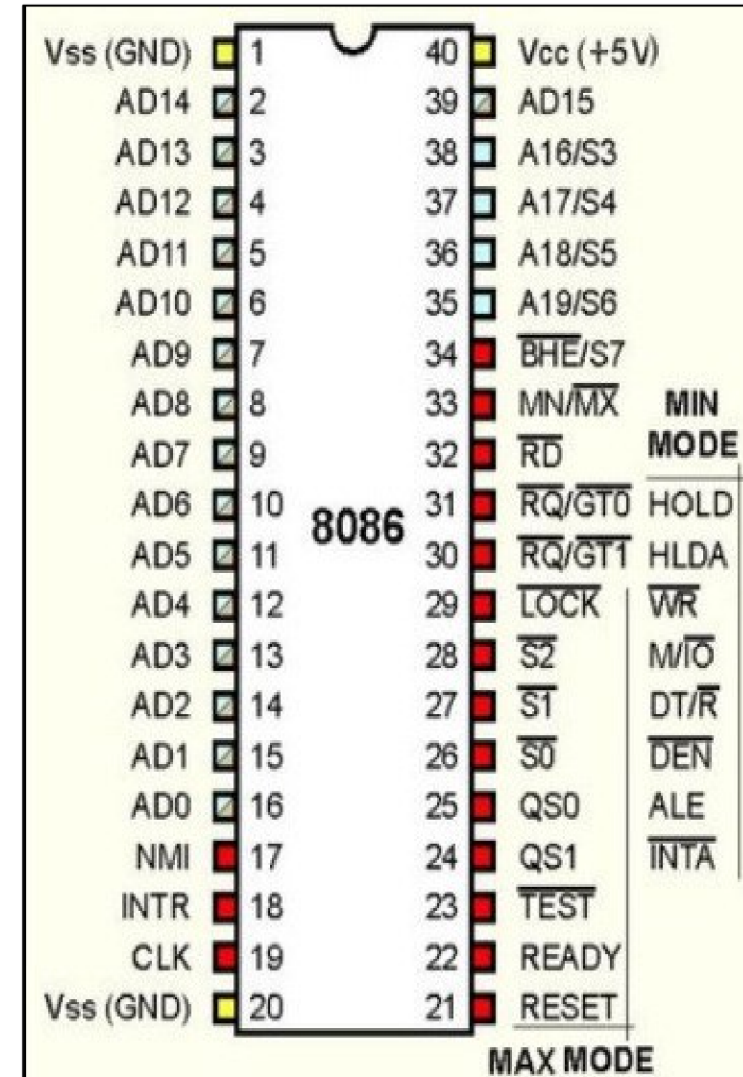
- **1st generation: 1945 - 1955**
 - Tubes, Punchcards
- **2nd generation: 1955 - 1965**
 - transistors
- **3rd generation: 1965 – 1980**
 - Integrated circuits
- **4th generation: 1980 –**
 - PCs and workstations

Introduction to 18086 μ p



- In 1972, Intel launched the **8008**, the first 8-bit microprocessor.
- It needed several additional ICs to produce a functional computer.
- In 1972, Intel launched **8080** employing the new 40-pin DIP.
- It originally developed for calculator ICs to enable a separate address bus.
- In 1977, Intel launched **8085** with a single +5 V power supply chip.
- Other well known 8-bit μ p: Motorola 6800, Zilog Z80 and others.
- In 1978, Intel launched **8086** (iAPX 86) as the first 16-bit μ p chip.
- It gave rise to x86 architecture family: Intel's most successful line of μ p.

Intel 8086 μ p Features & Hardware Architecture

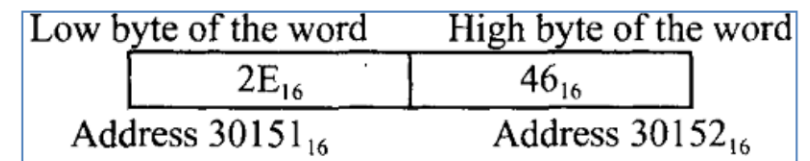
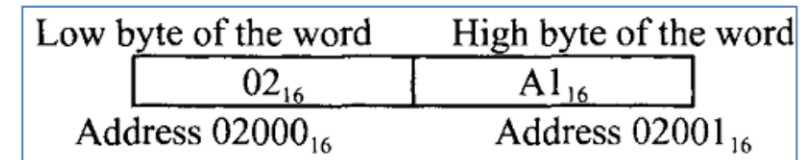


8086 μ p Features

- 8086 is the first 16-bit μ p released by Intel (1978).
 - 40-pin DIPs, 16-bit data bus (D0-D15) and 20-bit address bus (A0-A19).
 - Higher execution speed - larger memory size (of previous μ ps).
 - Run at 2.5 MIPS \rightarrow T_{exe} of one instruction = 400 ns ($=1/\text{MIPS}=1/(2.5 \times 10^6)$).
 - Contains a small pre-fetch 6-byte instruction queue \rightarrow **Pipelining**.
 - 8086 μ p is an example of a complex instruction set computer (CISC).
 - 8086 μ p is an example of a von Neumann Architecture (VNA) computer.
- Frequency Generation of 8086:
 - 8086 clock input signal is generated by 8284 clock generator chip.
 - Instruction execution times vary between 2 and 30 clock cycles.
 - Four versions: 8086 (5 MHz), 8086-1 (10 MHz), 8086-2 (8 MHz) & 8086-4 (4 MHz).

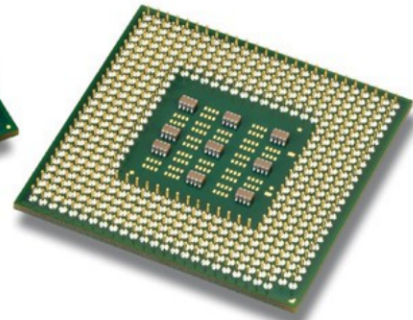
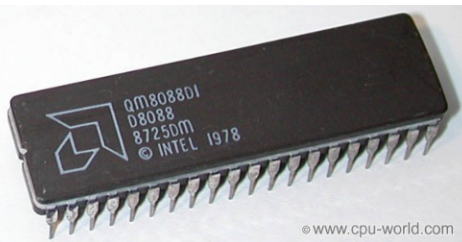
18086 μ p Features

- **Operational Power/ Temperature:**
 - requires +5.0 V (tolerance $\pm 10\%$) and a 360 mA (max).
 - operates in ambient temperatures of between 32° F and 180° F.
- **8086 Memory Addressing:**
 - 8086 has 20 address pins $\rightarrow 2^{20}$ bytes=1 MB of memory uniquely addressable.
 - 8086 memory is Byte addressable: 00000_{16} ; 00001_{16} ; $FFFFFF_{16}$.
- **8086 Memory Accessing:**
 - 8086 has 16 data pins \rightarrow can read 8-bit or 16-bit word (2- con. byte) from memory.
 - Word address can start at even or odd address. **Is this an issue?**
 - Ex1: The 16-bit word at address 02000_{16} is $A102_{16}$
 - Ex2: The 16-bit word at address 30151_{16} is $462E_{16}$



18086 μ p Features

- **8086 Registers Naming.**
 - 8086 register names followed by the letters X, H, or L (to specify 16 or 8-bit).
 - Examples: `MOV AX, [START]` `MOV AL, [START].`
- **8086 Modes of operation.**
 - Uniprocessor system (minimum mode: $\overline{MN}/\overline{MX}$ pin is tied to HIGH).
 - Multiprocessor system (Maximum mode: $\overline{MN}/\overline{MX}$ pin is tied to LOW).
- **Intel introduced many high-performance MP.**
 - 80186, 80286, 80386, 80486, Pentium 1, Pentium 2, Celeron, Pentium 3, Pentium 4 and others.



Thank you