Kazakh British Technical University

Informatics

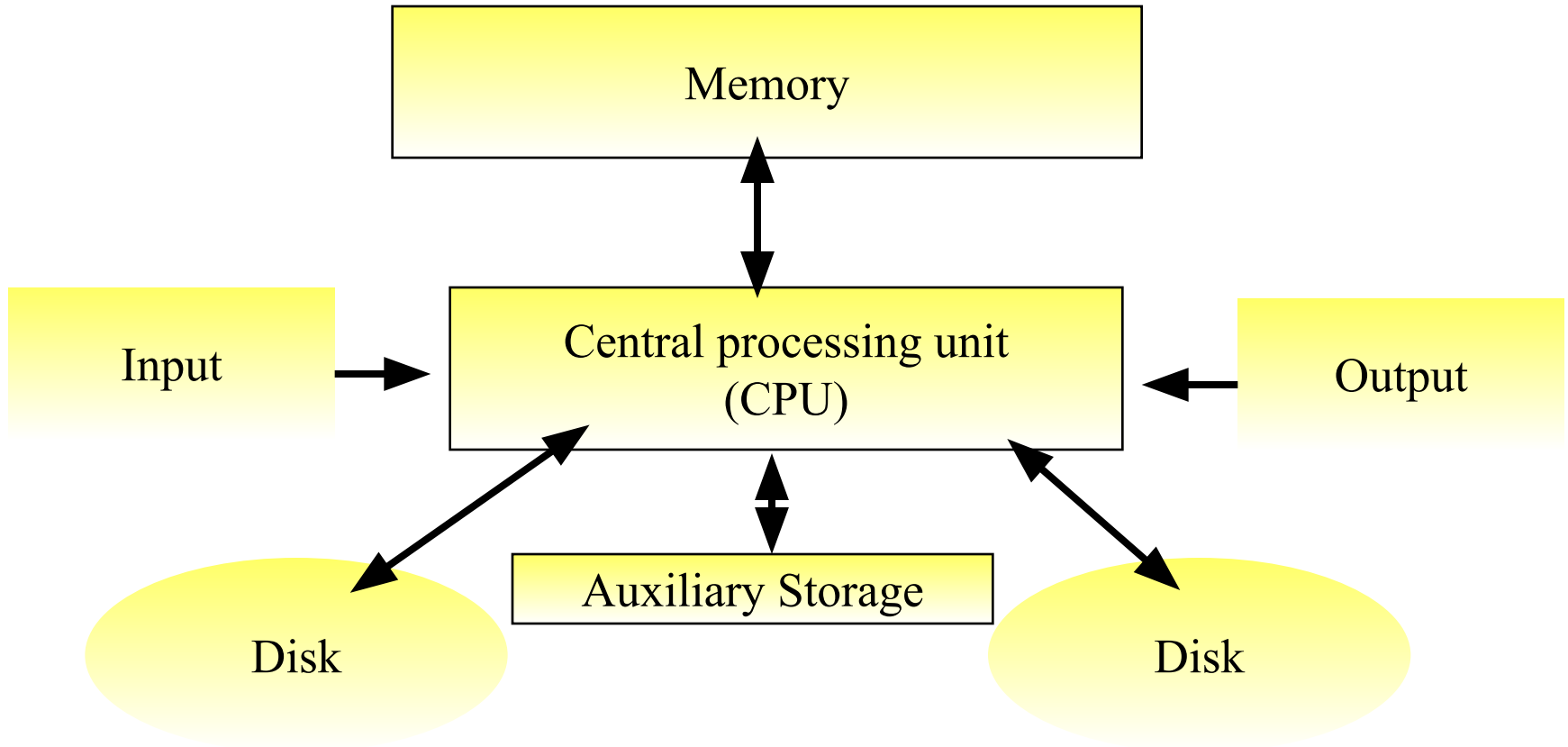Made by: *V. PopoV*

Almaty 2016

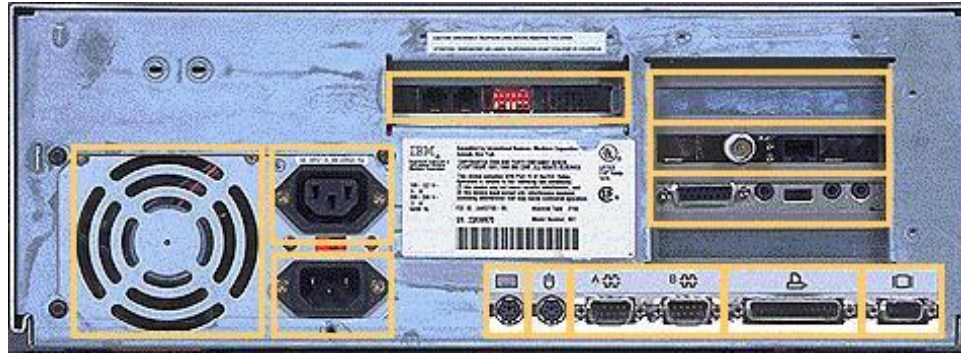# 2.Von Neumann architecture and PC Hardware

von Neumann Architecture

- 1946 - John von Neumann (Princeton)
- Developed stored program concept
  - both programs and data stored in same memory
- Modern computers said to use von Neumann architecture

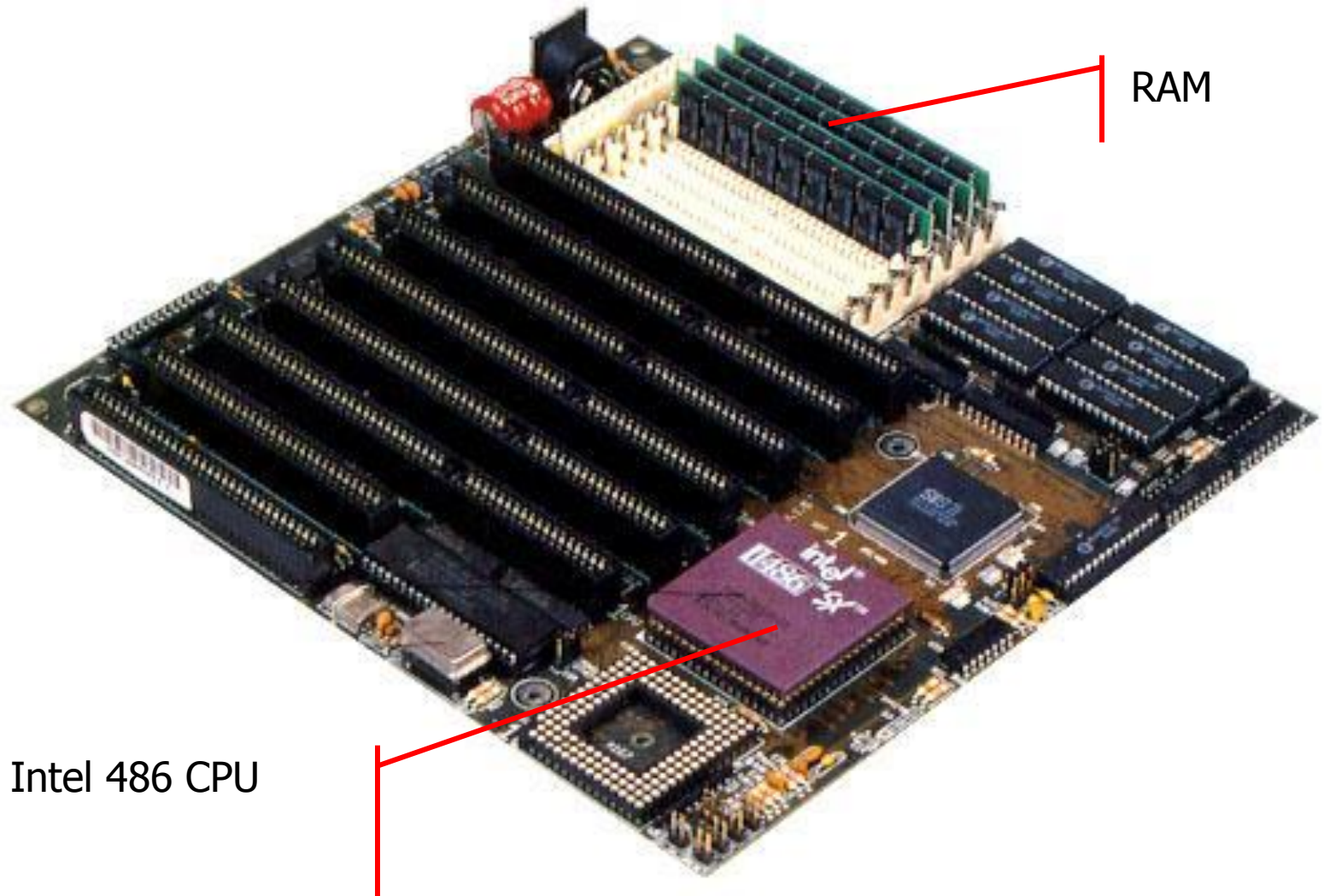# Any Computer System

Back of the Computer

- Cooling Fan
- Power Supply
- Keyboard Connector

- Mouse Connector
- Parallel Printer Port
- Video Connector

Inside the Computer

- CD-ROM
- CPU
- Expansion slots
- Floppy drive
- Hard disk
- Memory chip
- Motherboard
- Power supply

How the processor (CPU) is placed on the Motherboard

RAM

Intel 486 CPU

1975 - 1981

THE EVOLUTION OF PERSONAL COMPUTING

Personal computers have come a long way in a short time. Computers easy and inexpensive enough for individuals to buy were first developed in the mid-1970s. Since then, they have become smaller, faster, and more powerful.
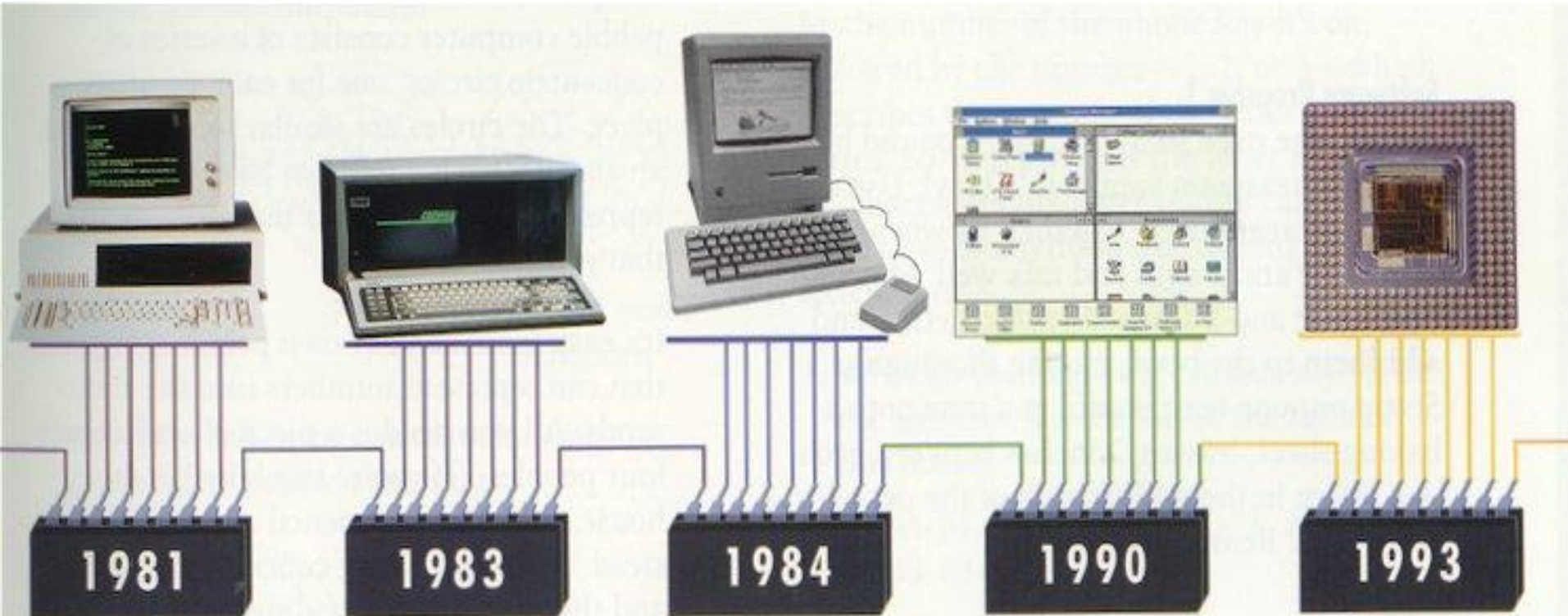
1975 — The Altair

1976 — The Apple I

1978 — The Floppy Disk

1980 — The Hard Disk

1981 — MS-DOS

1981 - 1993

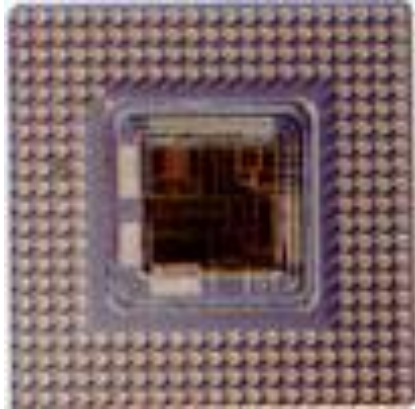| 1981 | 1983 | 1984 | 1990 | 1993 |

The IBM PC   **The Compaq portable Computer**   **The Apple Macintosh**   **MS-Windows 3.0**   **The Pentium Chip**
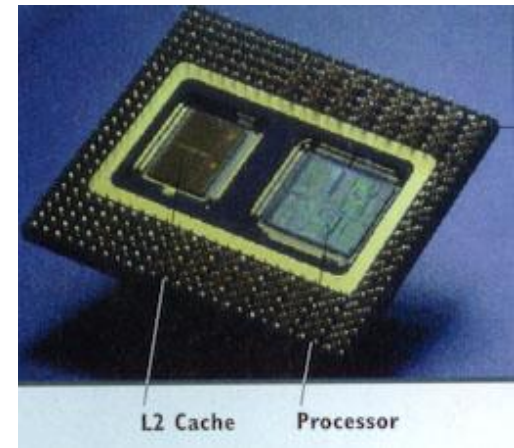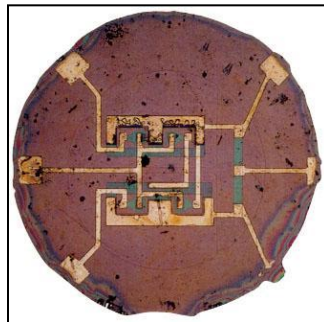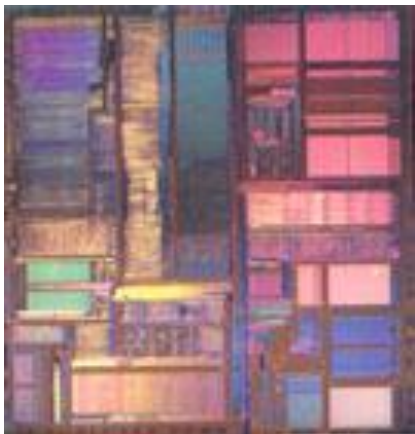
Intel Pentium Processors

PENTIUM

PENTIUM Pro

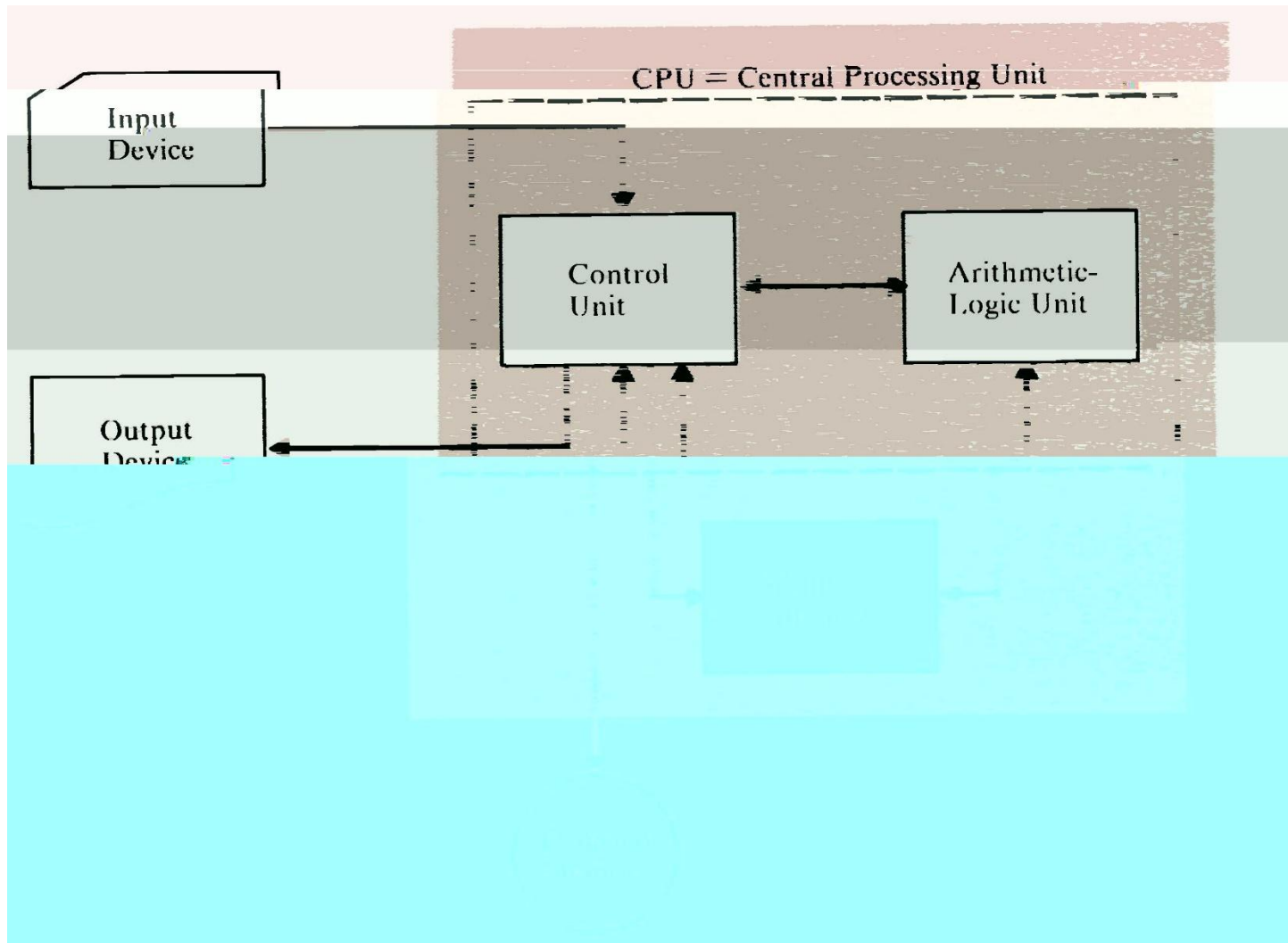PENTIUM II

Computer Components

- CPU - Central Processing Unit
    - controls operation of entire systems
    - performs arithmetic and logic operations
    - stores and retrieves instructions and data

contains

    - ALU - Arithmetic-Logic Unit
    - Control Unit

Computer System Architecture

CPU = Central Processing Unit

Input Device

Control Unit

Arithmetic-Logic Unit

Output Device

Components (con't)

- Main memory (internal or primary memory)
  - RAM - Random Access Memory
  - stores instructions and data temporarily
- Secondary memory (external or auxiliary)
  - magnetic disk (hard disk or floppy)
  - magnetic tape
- Peripherals - used for Input/Output
  - keyboard, printer, monitor, etc.

# Internal Representation

- Each unit of memory a two-state device
  - off or on, 0 or 1
  - represent in Binary, two Binary Digits (bits)
- Organized into groups of 8 bits - bytes
  - represents single keyboard character
- Larger grouping of 16 or 32 bits - word
  - represents single integer value
  - identified by address for access

The Microprocessor

- - Microprocessor (**CPU** - **C**entral **P**rocessing **U**nit)- logic, and control are on a single chip.
  - generations of Intel micro processors
    - 8088 (XT), 80286 (AT), 80386, 80486, Pentium (+MMX), Pentium Pro.
    - all are obsolete with the exception of high end Pentiums and Pentium Pros.

The Microprocessor
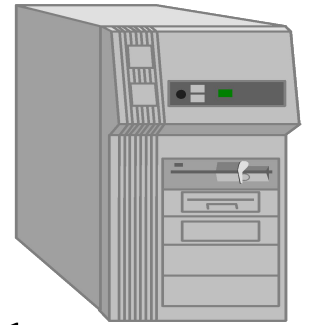
- The speed of a microprocessor is dependent on 2 things…
  - the generation of the microprocessor
  - the clock speed
    - indicates how fast instructions are processed.
    - measured in MHz (millions of cycles per second)

The Microprocessor
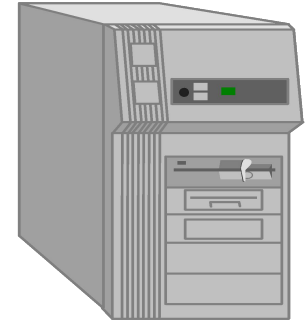
- Example:
  - A 200 MHz Pentium is faster than a 166 MHz Pentium.
  - but how much faster.
  - how much faster is a Pentium Pro 200 MHz compared to a Pentium 133 MHz.

Primary Memory

- Primary Memory (RAM)- A temporary storage area that holds data instructions, results, and passes information back and forth to the CPU.
  - the larger the memory the more sophisticated programs can run.
  - more programs can remain in memory at the same time.
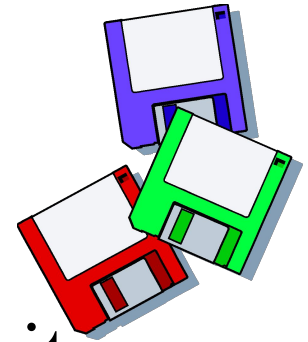 - the faster the system.
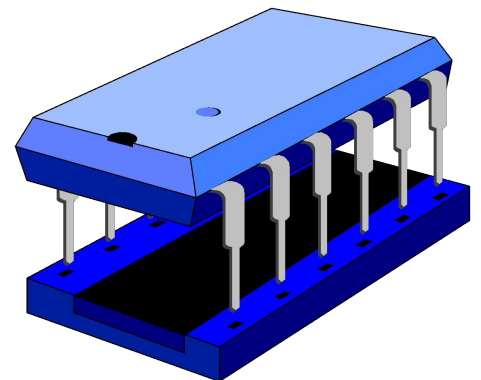
Primary Memory

- We need an permanent storage area.
- This permanent memory is called secondary or auxiliary storage.
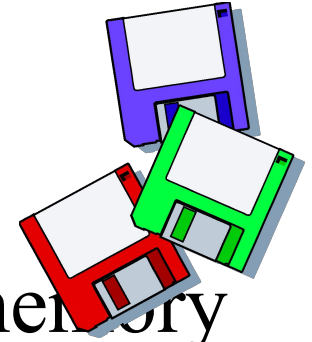 - types ???
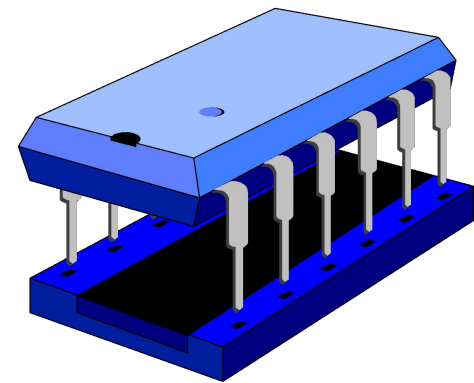
Auxiliary Storage

- A permanent storage device that retains its contents when the power is turned off.
    - hard (fixed) Disk - remains permanently inside the system unit. (uses metal platters)
    - floppy disk - is portable and is made up of a plastic disk, enclosed in a hard plastic case.

Auxiliary Storage

- CD-ROM - compact disk read only memory
  - you can read from the CD but can not write to it.
  - CD hold approx.. 650MB of data.
- CD-Recordable, DVD-Recordable
  - allows you to read and write to a CD, DVD.

CD-ROM and Recordable
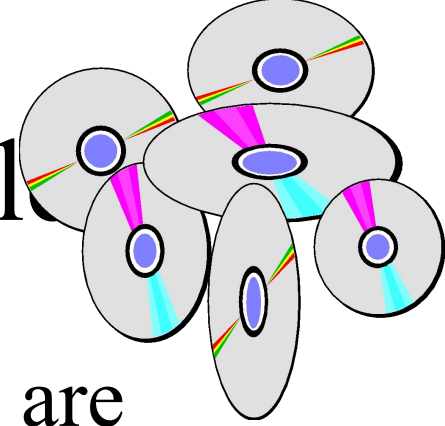
- Speeds of CD-ROMs and recordables are measured by
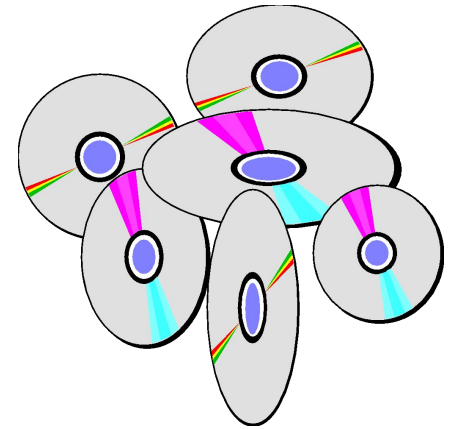 - access Time: The average time to find a specific item.
  - transfer Rate: The amount of data that is read/second

CD-ROMs and Recordables

- 1st CD-ROMs had speeds of 600 millisecond access time and transfer rates of 150 KB.

- 32 times the original speed (32X).

The Local Bus
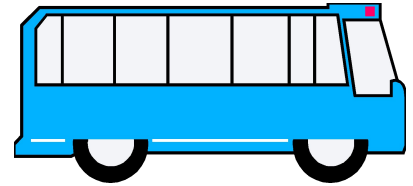
- The Bus is
  - the circuitry on the motherboard (the main board that holds the microprocessor, memory, and adapter cards) that
  - provides a path for which data travels from one component to another.

The Local Bus
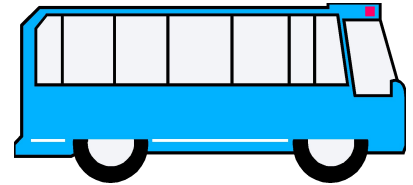
- Today's PCs have multiple local buses
  - each Bus is 32bits wide and travels as fast as the microprocessor.
  - each Bus is connected to a specific device and does not have to share it with other components.
  - PCI - A bus designed by Intel for the Pentium or Pentium Pro.

Printer
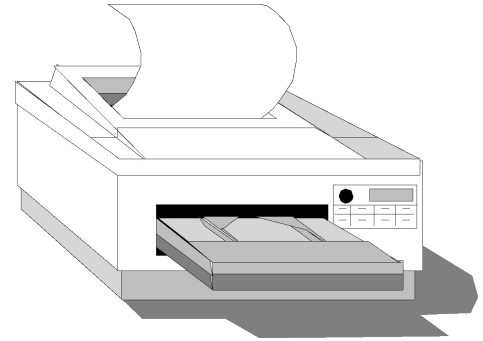
- Printers
  - Dot Matrix
    - lots of noise
    - bad Print Quality
  - Inkjet
    - today's entry level printer
    - quite and pretty good speed
  - Laser
    - top of the line
    - quality measured in PPM and DPI.

Modem
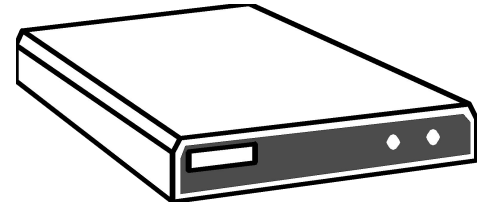
- Connects you computer to the outside worlds
- Modulate - Converts a digital signal into an analog one
- Demodulate - Converts an analog signal to a digital one.
- **Modem** = **Mo**dulate **dem**odulate
- Example

Modem
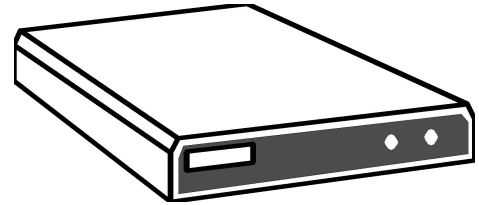
- Speed is measured in BPS (Bits per second)
- Standard speed today is 56k BPS
- Today the standard is a FAX/MODEM where you get the functions of a MODEM and a FAX machine on one card.

Sound Card

- 2 Functions
  - play previous recorded sound (translates a digital file into sound)
  - to record new sound (translate sound into a digital file)
- Need good speakers

Video

- 2 major components
  - monitor
  - display Adapter (Video Card)
- Monitor
  - pixels
  - dot pitch
  - vertical refresh rate
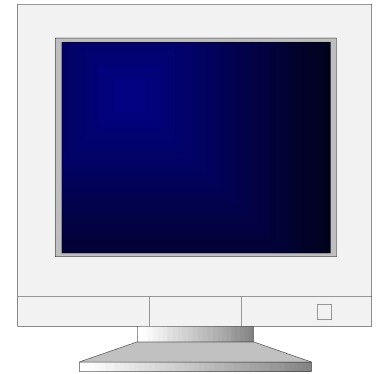
Monitor Quality

- **Pixels** - (**PIC**ture **EL**ement**S**)
  - the number of dots that make up a picture
  - measured by
  - # of dots across   X   # of dots down
    - 800   X   600
  - in this example the max number of pixels that can be displayed on any monitor is 800 X 600 = 480,000

Monitor Quality

- This formula (Pixels across **X** Pixels down) is called the **resolution**.

- The bigger the monitor the larger the dots and the easier it is to see the image

- The higher the resolution the sharper the image.

- But…

Monitor Quality
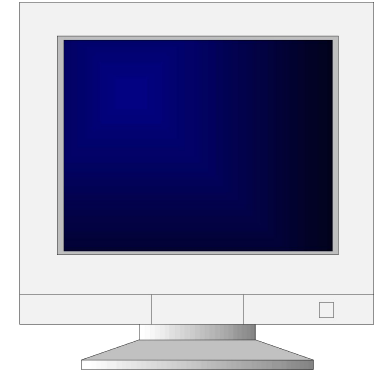
- What happens when...

  - small Monitor and High Resolution
    - 14"   1280 X 1024 (1,310,720)
  - large Monitor and Low Resolution
    - 20"   640 X 480 (307,200)

- Need a balance between resolution and monitor size.

Resolution and Monitor Size

Resolution	Min Pixels	Screen Size
640 X 480 (VGA)	307,200	14"
800 X 600 (Super VGA)	480,000	15"
1024 X 768 (Extended VGA)	782,462	17"
1280 X 1024	1,310,720	20"
1280 X 720P (HD)		
1920 X 1080p (Full HD)		

Monitor Quality
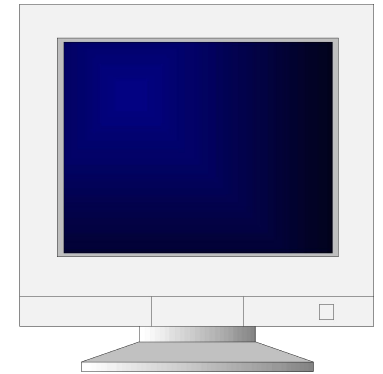
- **Dot Pitch** -
  - distance between adjacent Pixels
- The smaller the dot pitch the crisper the image (good) the larger the dot pitch the more grainy the image (bad).
- Get a monitor with a dot pitch less than .28 mm.

Monitor Quality

- **Vertical refresh rate**
  - how fast the screen is repainted (refreshed) from top to bottom

- If it is too slow the screen will flicker.

- Get 70MHz (70 cycles per second) or faster.

Display Adapter

- Display (video) adapter - accepts info from the CPU and sends it to the monitor to display the image
  - get one with an accelerator chip. The video card will have its own processing chip. Freeing up the CPU to do other things.
  - the video card should also have its own memory (at least 1 GB).

Computer Software

Software

- Software instructs the hardware what to do, and uses the hardware to perform specific tasks.
- Such as display information on a screen, format a floppy disk, etc. There are 2 main types of software
- What are the types...

Types of Software

- Operating systems
  - a set of programs that manage the computer (e.g. loads & controls the execution of other programs, manages the storage of data on disks)

  - examples???

Types of Software

- Applications Software:
  - Programs written for specific purposes in order to perform functions specified by end users.

  - Why do we need them ???

  - Examples ???

History of a software

Figure 1.7 Layers of languages at the end of the first generation
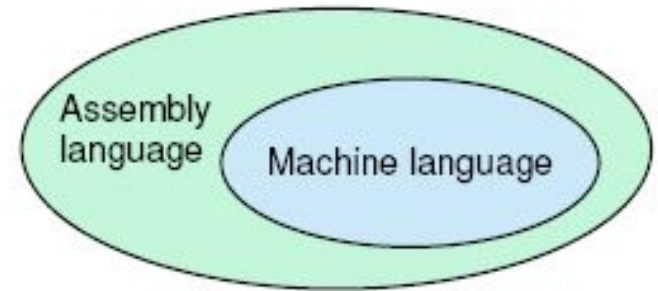
- The first programs were written using machine language, the instructions built into the electrical circuitry of a particular computer.
- Even, the small task of adding two numbers together used three instructions written in *binary* (1s and 0s)
- *Assembly languages*, developed later, used mnemonic codes to represent each machine-language instruction.

The 2nd generation of sw

- Two of the *high-level languages* languages developed during the second generation are still used today.

- They are FORTRAN (a language designed for numerical applications)

- and COBOL (a language designed for business applications).
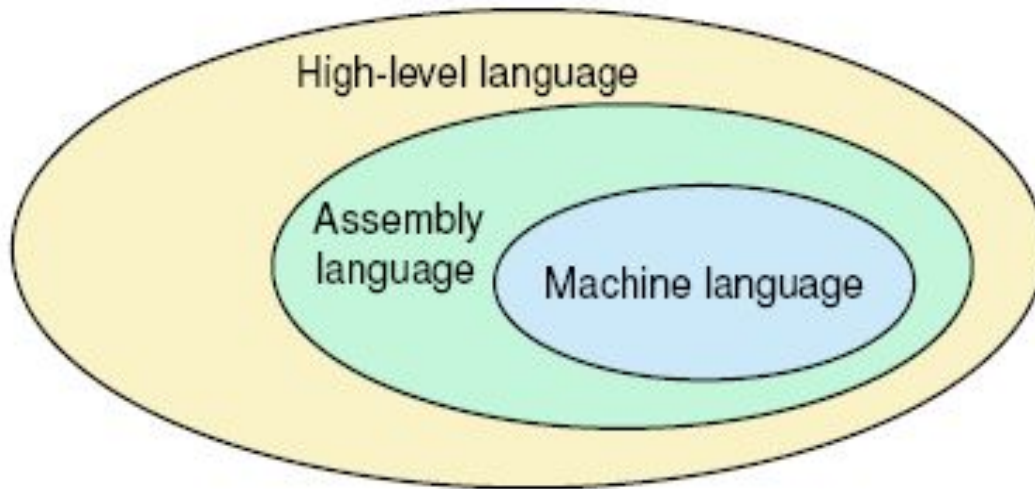
The 2ⁿᵈ generation of sw

Figure 1.8
Layers of language at the end of the second generation

The introduction of high-level languages provided the ability for running the same program on more than one computer.
Each high-level language has a translating program that goes with it.
A program translated and run on any machine that has a translating program called a *compiler*.
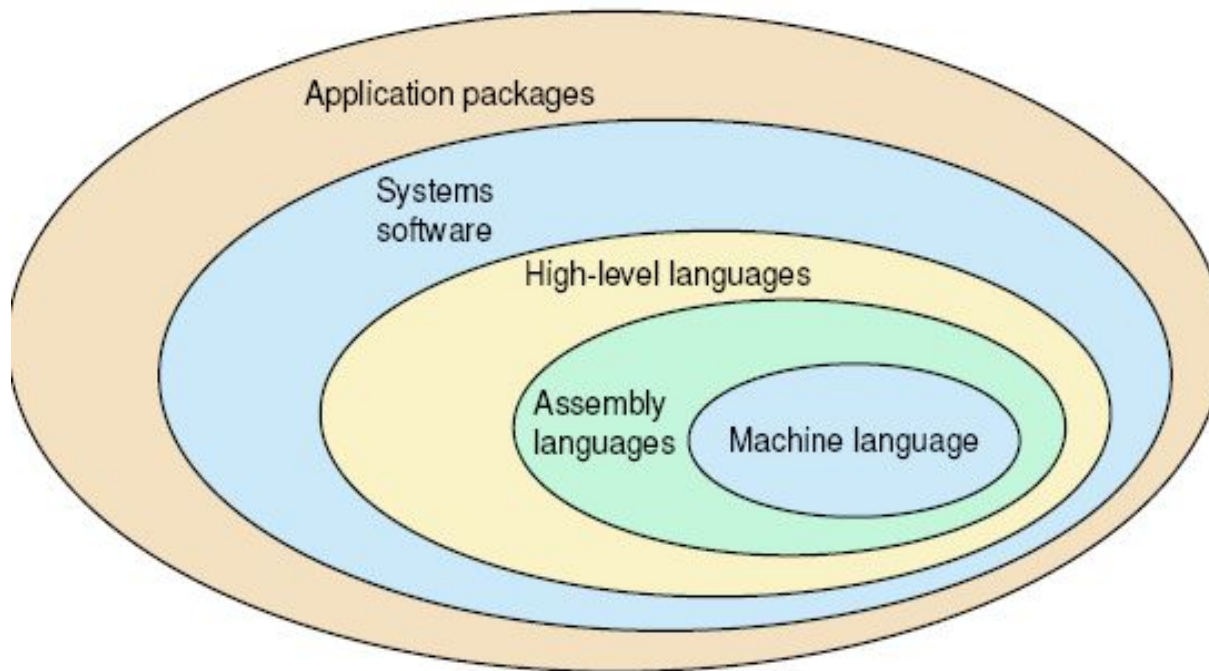
The 3ʳᵈ generation of sw

Figure 1.9
The layers of software surrounding the hardware continue to grow

Subareas of Computer Science

- Algorithms and data structures
- Programming languages
- Architecture
- Numerical and symbolic computation
- Operating systems
- Software methodology and engineering
- Databases and information retrieval
- Artificial intelligence and robotics
- Human–computer Interaction
- Graphics
- Organizational informatics
- Bioinformatics