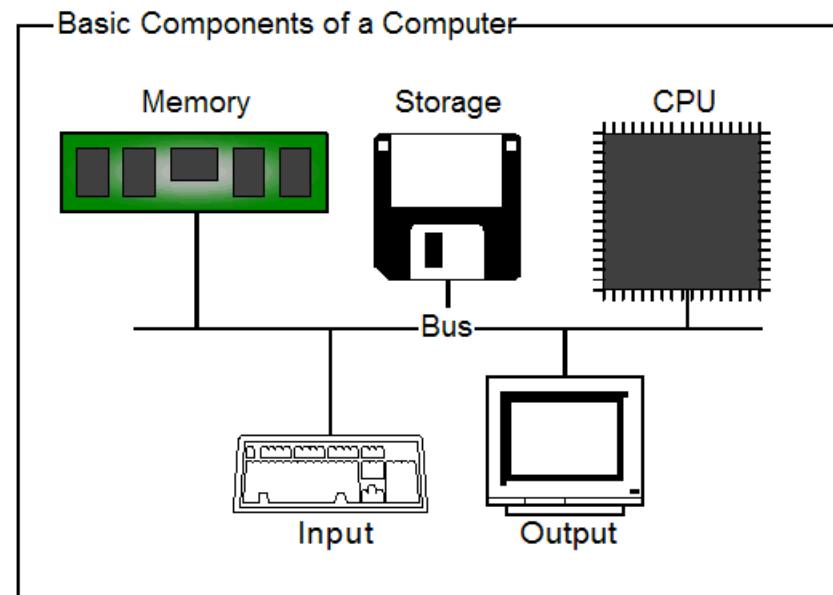


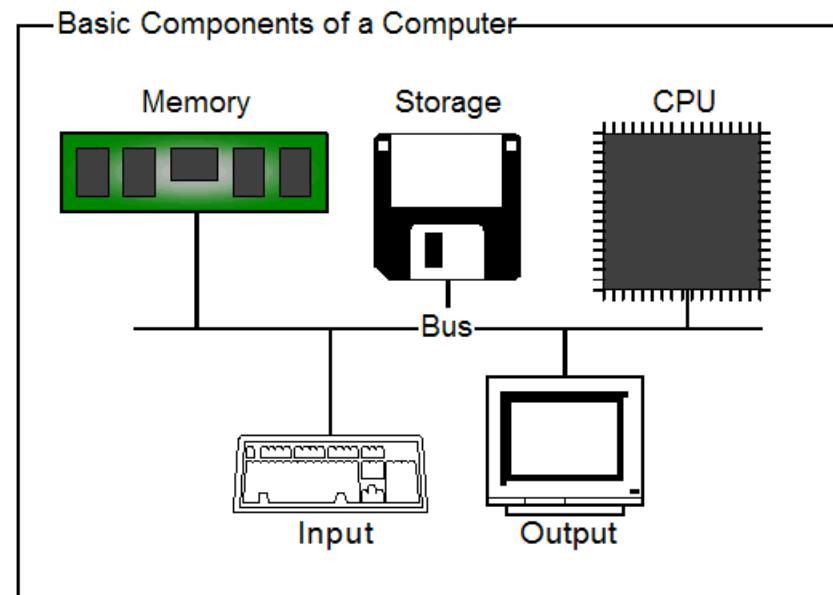
Continue about Computers

- CPU (Central Processing Unit) ← last lecture
- Memory (RAM)
- More about Memories ← Today ...
- I/O (Input/Output) units = peripheral devices
- Computer Systems ...



Continue about Computers

- CPU (Central Processing Unit) ← last lecture
- Memory (RAM)
- More about Memories ← Today ...
- I/O (Input/Output) units = peripheral devices
- Computer Systems ...



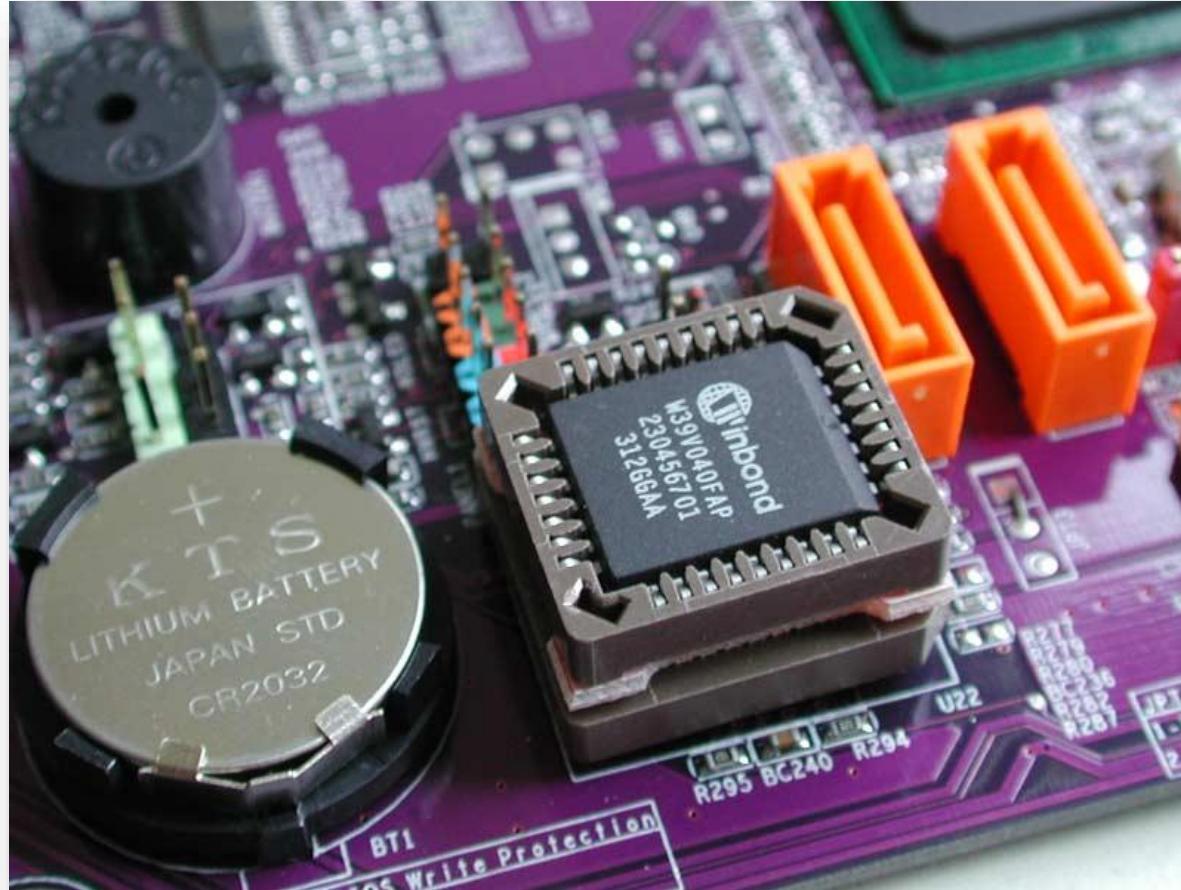
More memories...

- ROM
- Flash
- Cache

ROM

- Read Only Memory (ROM) has programs and instructions already stored in it by the manufacturer. These programs and instructions may be “read” but not changed in any way. They are “permanent”.
- Programs read in ROM’s are often called “Firmware”. Example: **BIOS** (**B**asic **I**nput / **O**utput **S**ystem) ROMs
- The BIOS loads and starts the operating system (windows).

BIOS Chip ... on the motherboard



Evolution to Flash (EEPROM)

- Mask Programmable ROM (Prog. by the manufacturer)
- UV PROM (Ultra Violet PROM)
- EEPROM
- (EEPROM) Electrically Erasable Programmable Read Only Memory
- ROM/PROM, UV PROM, EEPROM ... non-volatile memory

Flash Memory ...

- The Flash Memory, like EEPROM, can be erased using the normal voltages inside a PC ... cell phone, camera, ...
- Flash memory = non-volatile (permanent)

Flash Memory

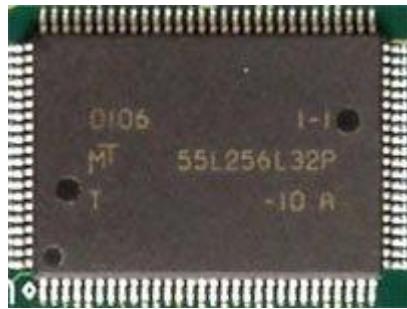
- Today, Flash-memory -chips are not widely used in general computer systems.
- Flash memory can be found:
 - ThumbDrive (memory stick)
 - MP3 players
 - Cellular phones
 - Network routing
 - Cockpit flight recorders (airplanes)
 - Computer flash BIOS chips
 - Digital Cameras
 - Personal Digital Assistants (PDA)

Flash Memory Chips



Cache Memory

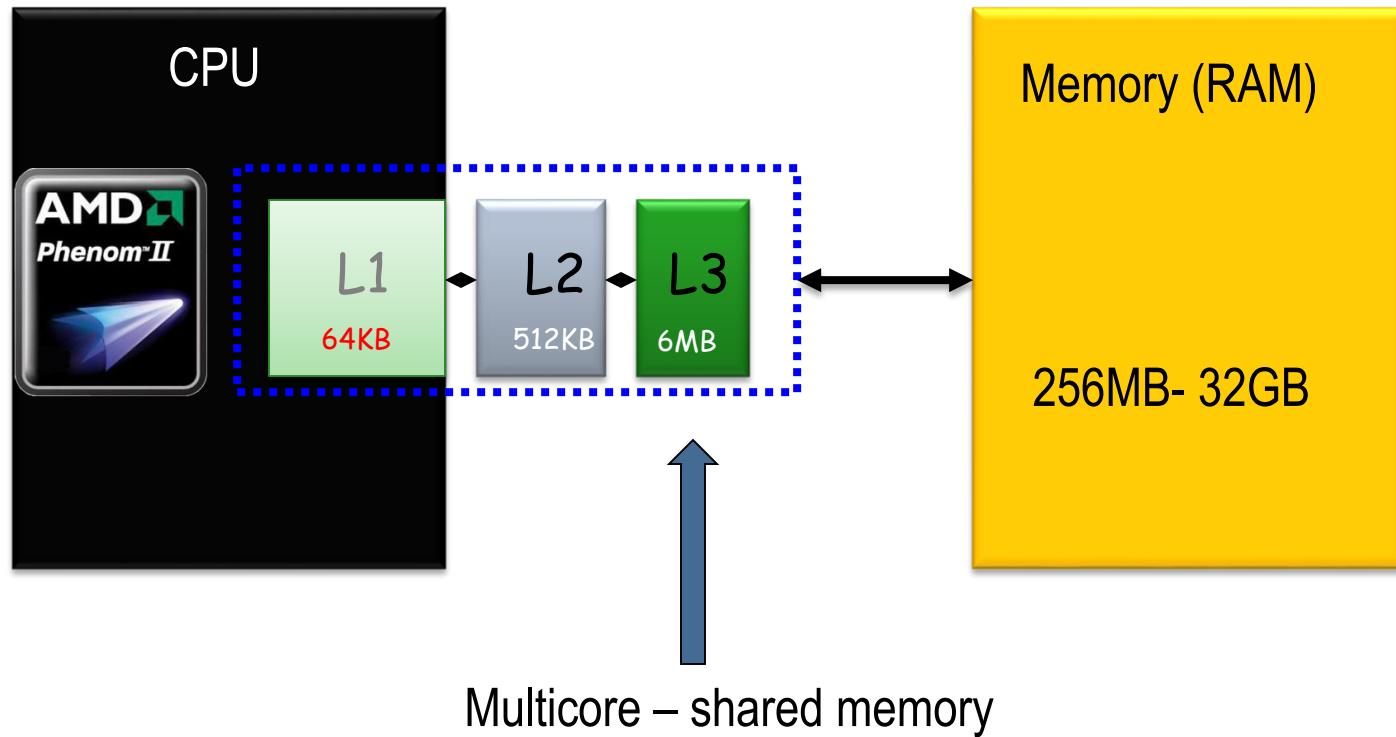
- Cacher in French = Hide
- Pronounced “cash”



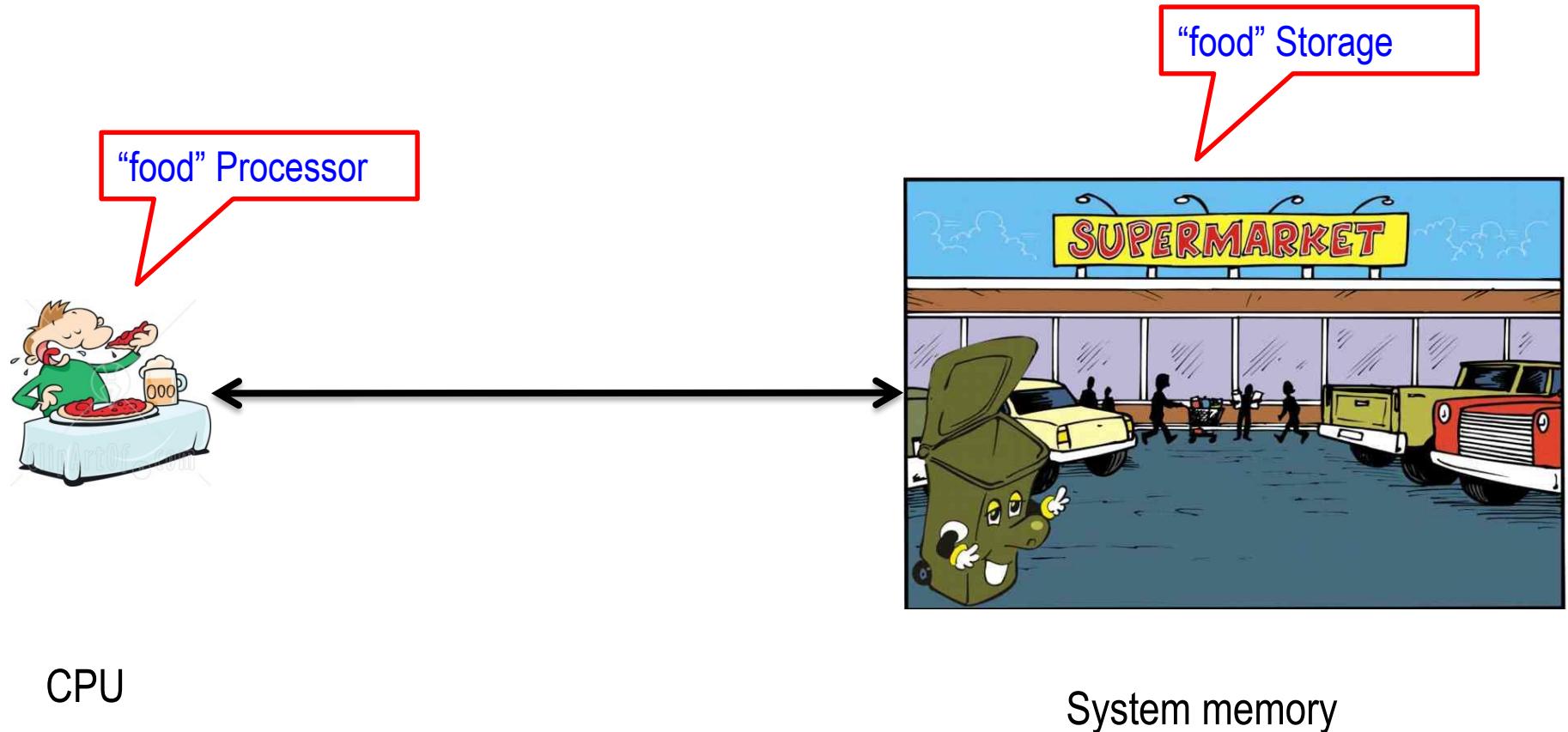
Cache Memory

- The cache memory (volatile) is built into the processor design.
- It is located between the main memory and the CPU
- It is relatively small in capacity and designed to speed up the internal transfer of data and instructions.

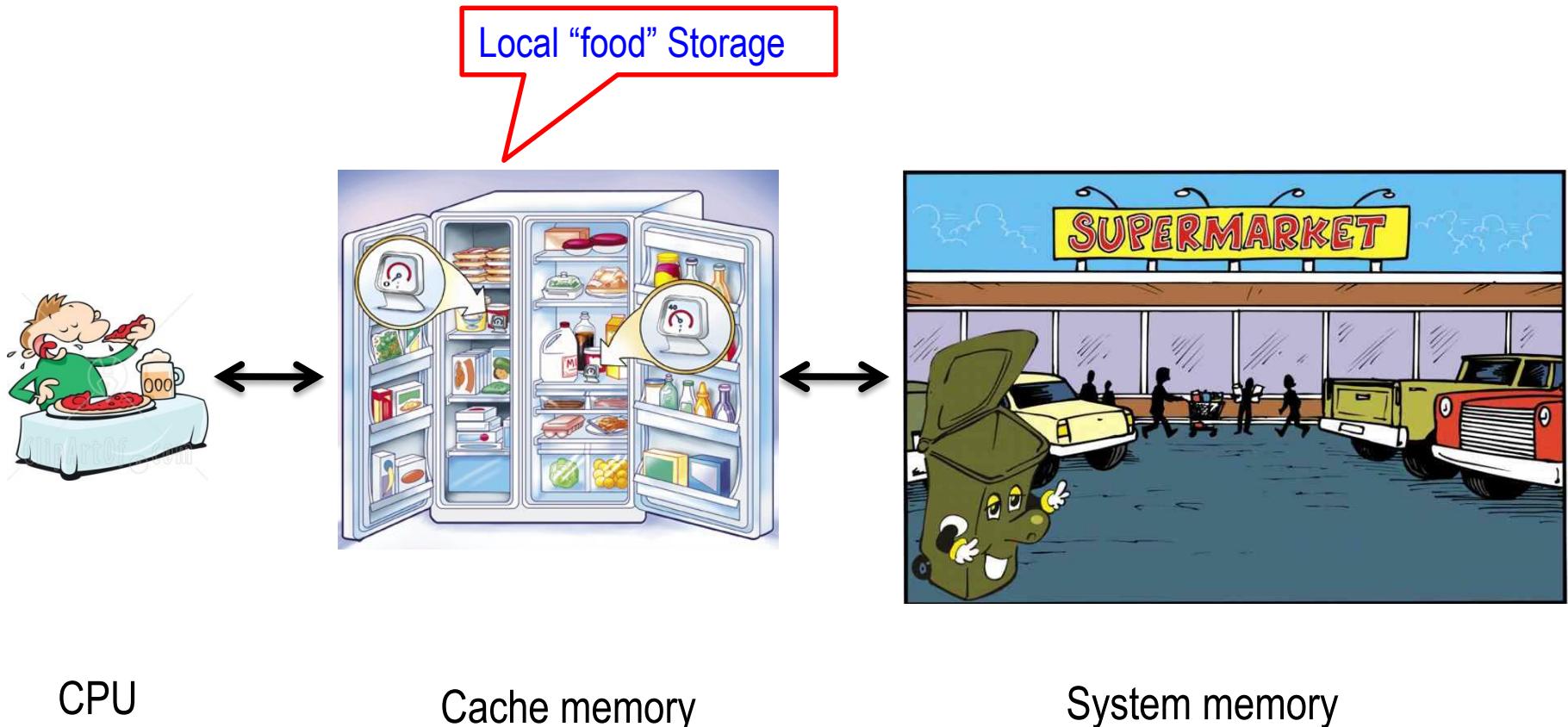
Cache Memory ...



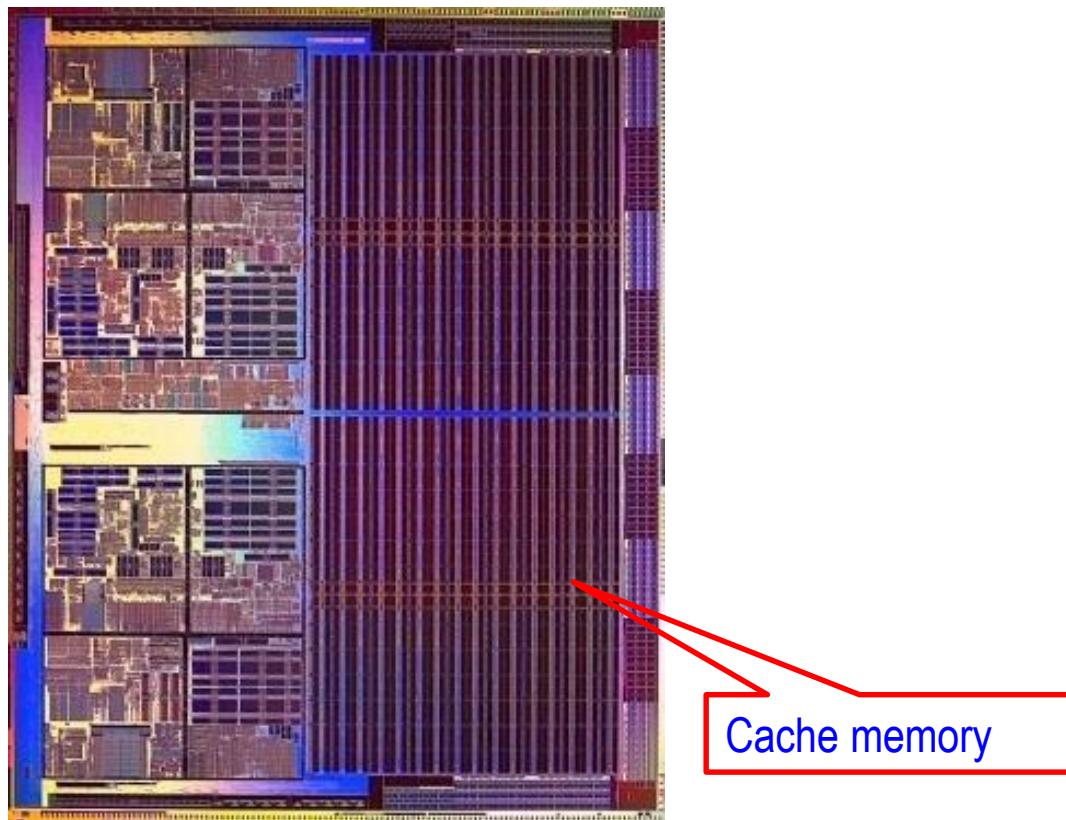
CPU and System Memory



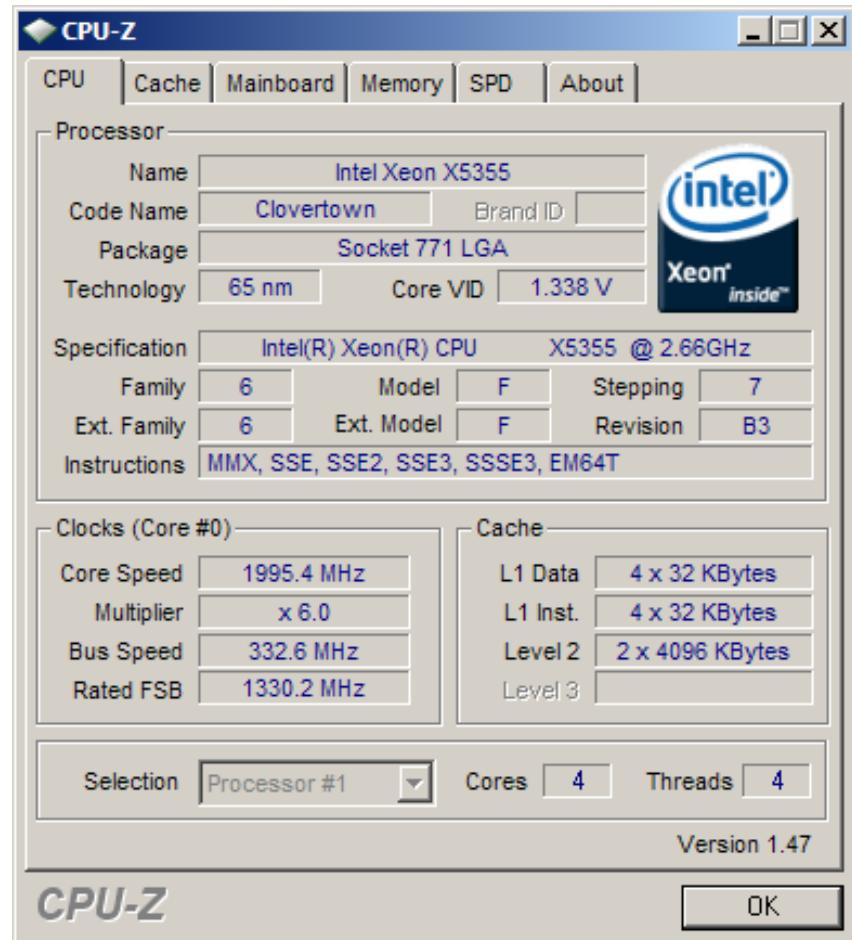
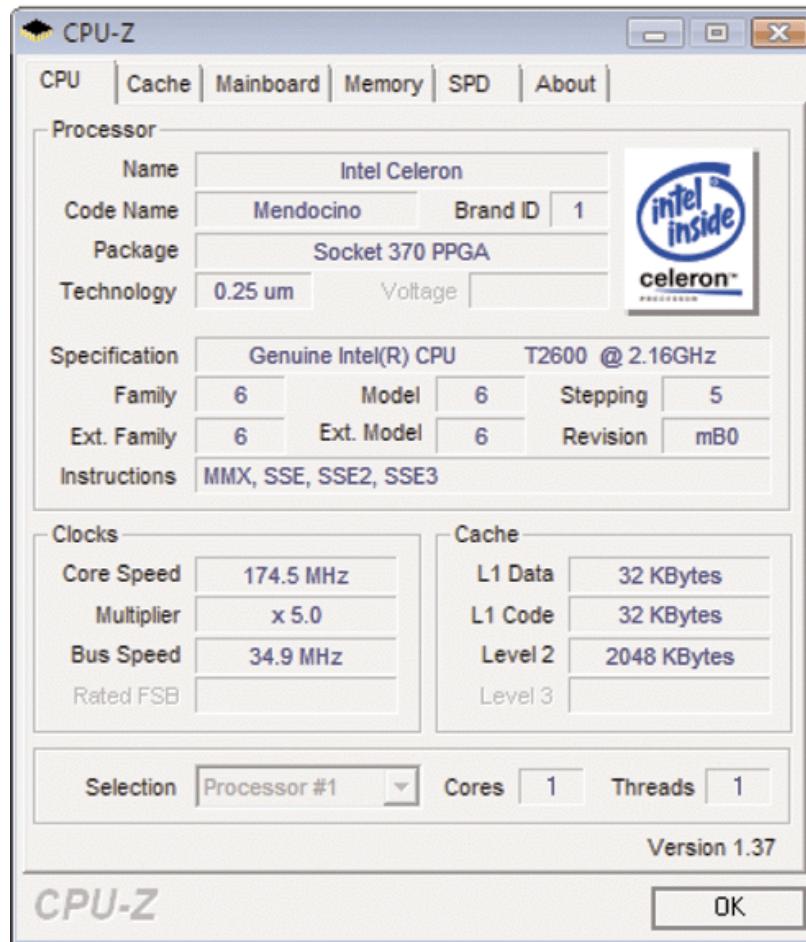
Cache memory



CPU Core with Cache Memory



Cache Memory



Use this program: CPU-Z

<http://www.cpuid.com/cpuz.php>

Cache and Virtual memories

- Primary goal of Cache:
 - Increase Speed of the computer system
- Primary goal of Virtual Memory:
 - Increase Memory Space

Secondary memory

- Hard disk
- Floppy disk
- USB Flash Memory Pen Drives
- Solid State Drive (SSD)
- Optical disks
- Tapes

Secondary Memory

- Cheaper than primary
- Slower than primary
- Non-volatile (permanent)

Hard Disk - Drives

Size of Hard disks:

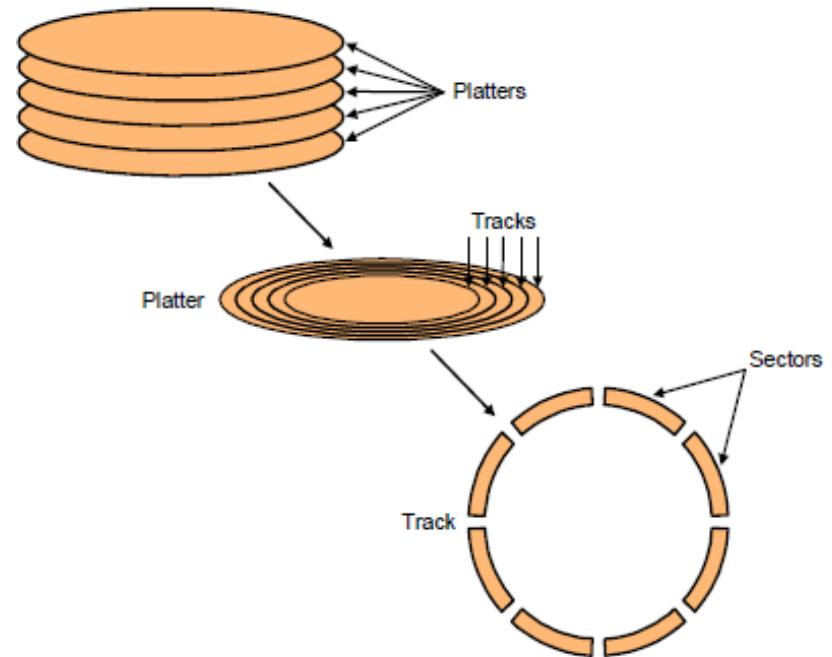
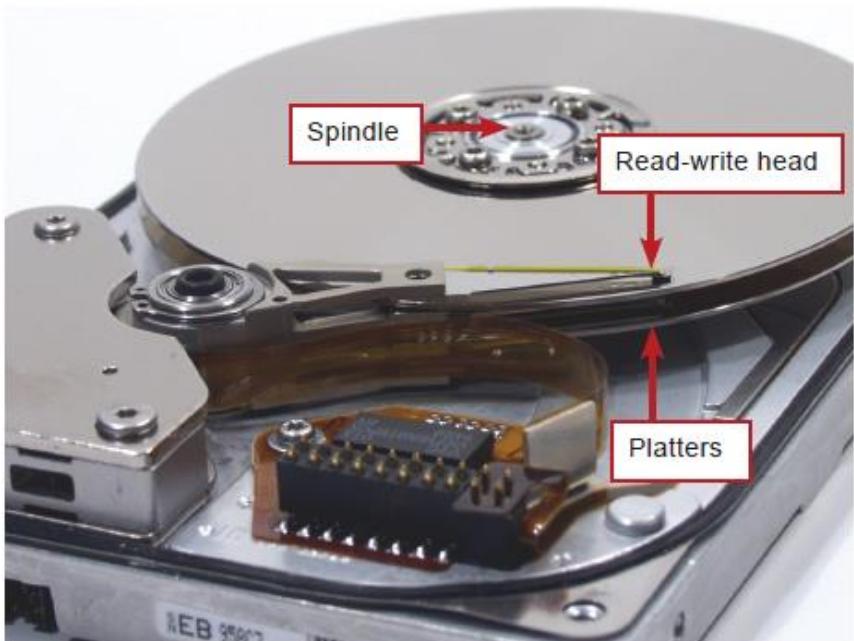
- Up to ... **8.0** TB

There are a few types of hard drives:

- PATA (Parallel Advanced Technology Attachment)
- **SATA** (Serial Advanced Technology Attachment)
- SCSI (Small Computer System Interface)

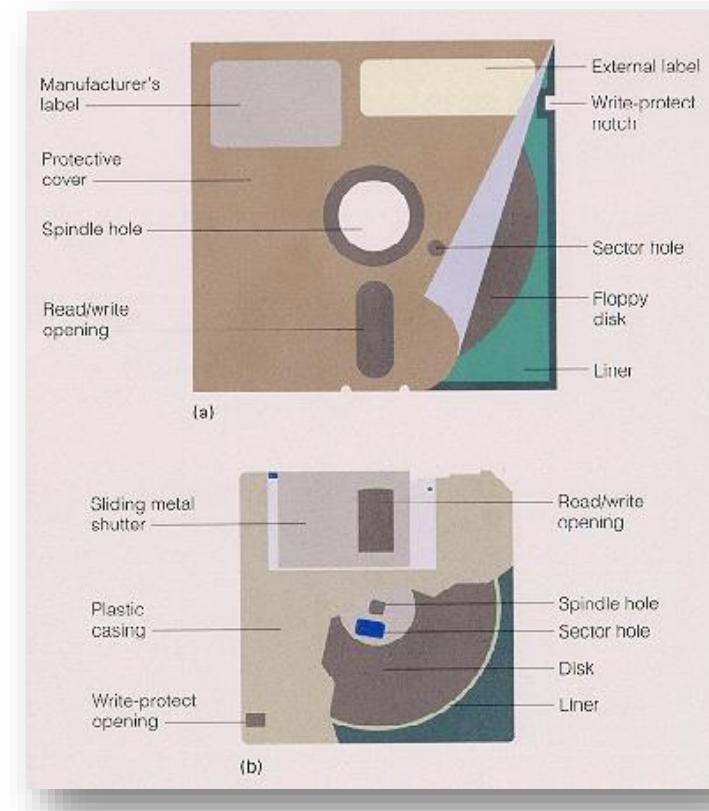


Hard Disk



Floppy Disks

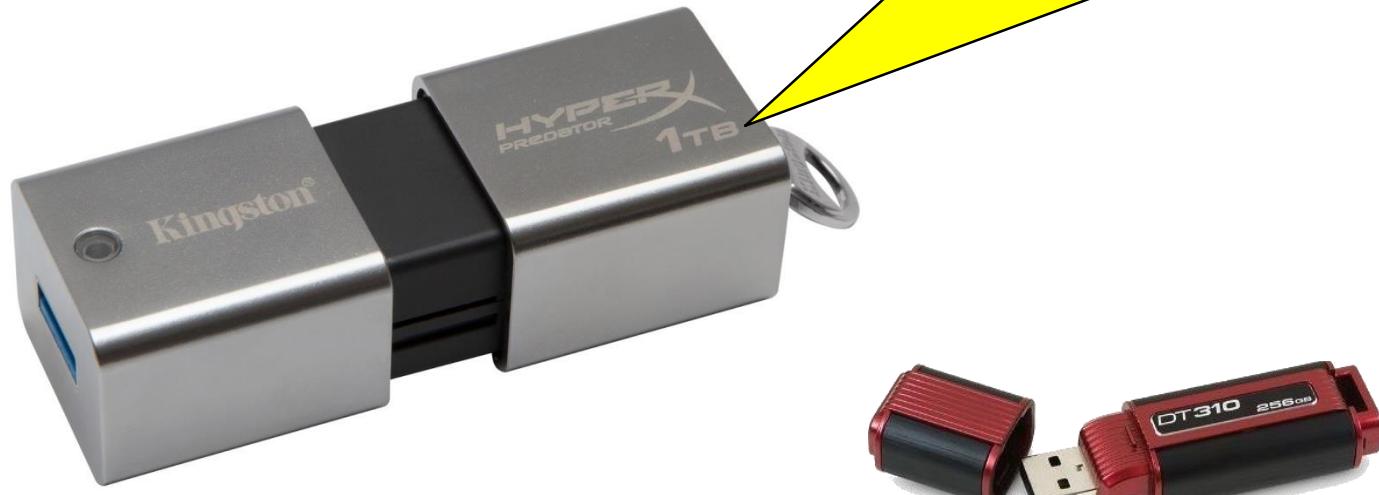
- 5 and 1/4-inch-diameter
- 3 and 1/2-inch-diameter



USB Flash Drives

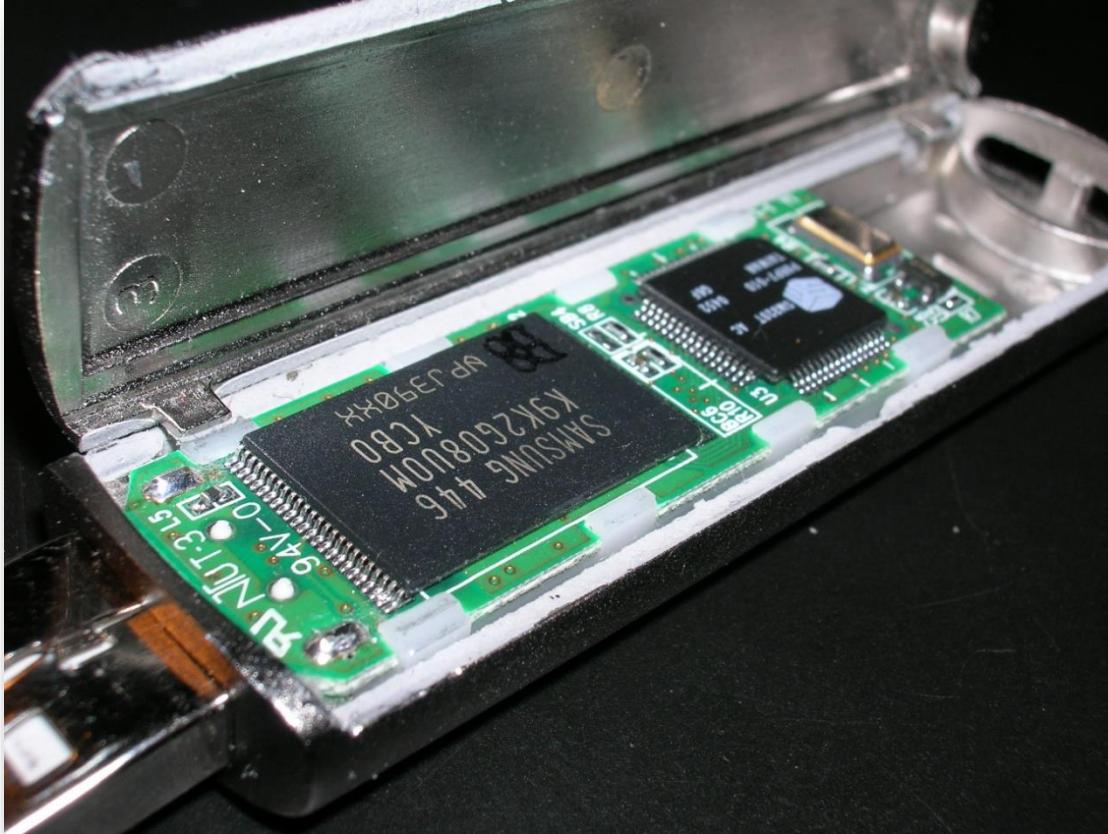
- USB Flash Memory Drives are used to easily store files such as:
 - Digital pictures
 - Mp3s
 - Movies/Video
 - WORD documents,

Today can store information up to 1 TB



USB: Universal Serial Bus

Inside a ... USB Flash Drive

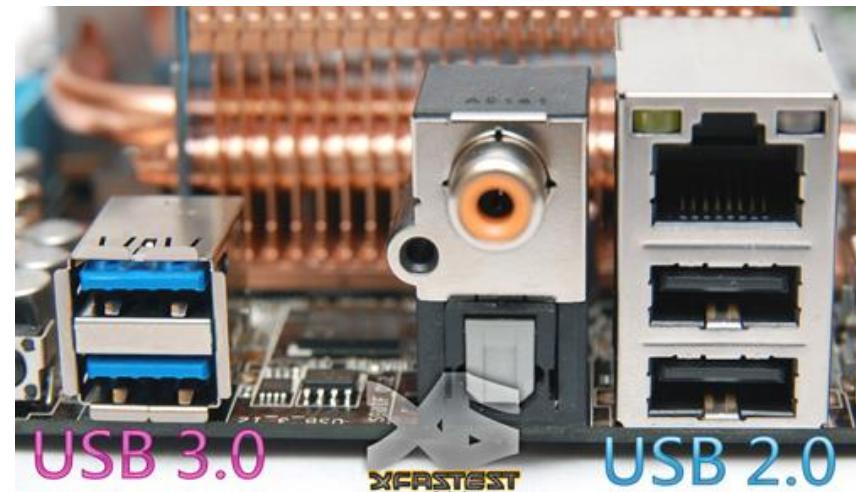


USB: Universal Serial Bus

USB port ...

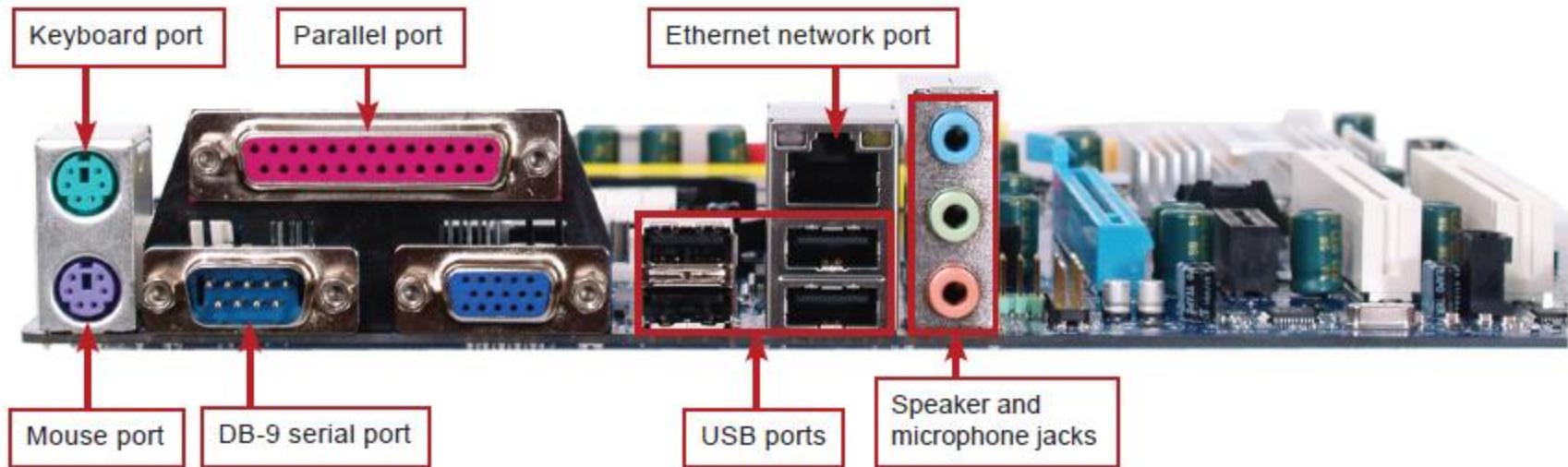


A USB connector is shaped like a flat rectangle. Make sure you know which side of the plug is up; the top is usually labeled with the USB logo.



USB: Universal Serial Bus

More ...ports for devices



What is SSD? (1 TB)

- Solid State Drive (Disk)
- Flash memory that replaces a hard disk
- It is fast
- More efficient than a hard disk
- Very Expensive
- Quiet

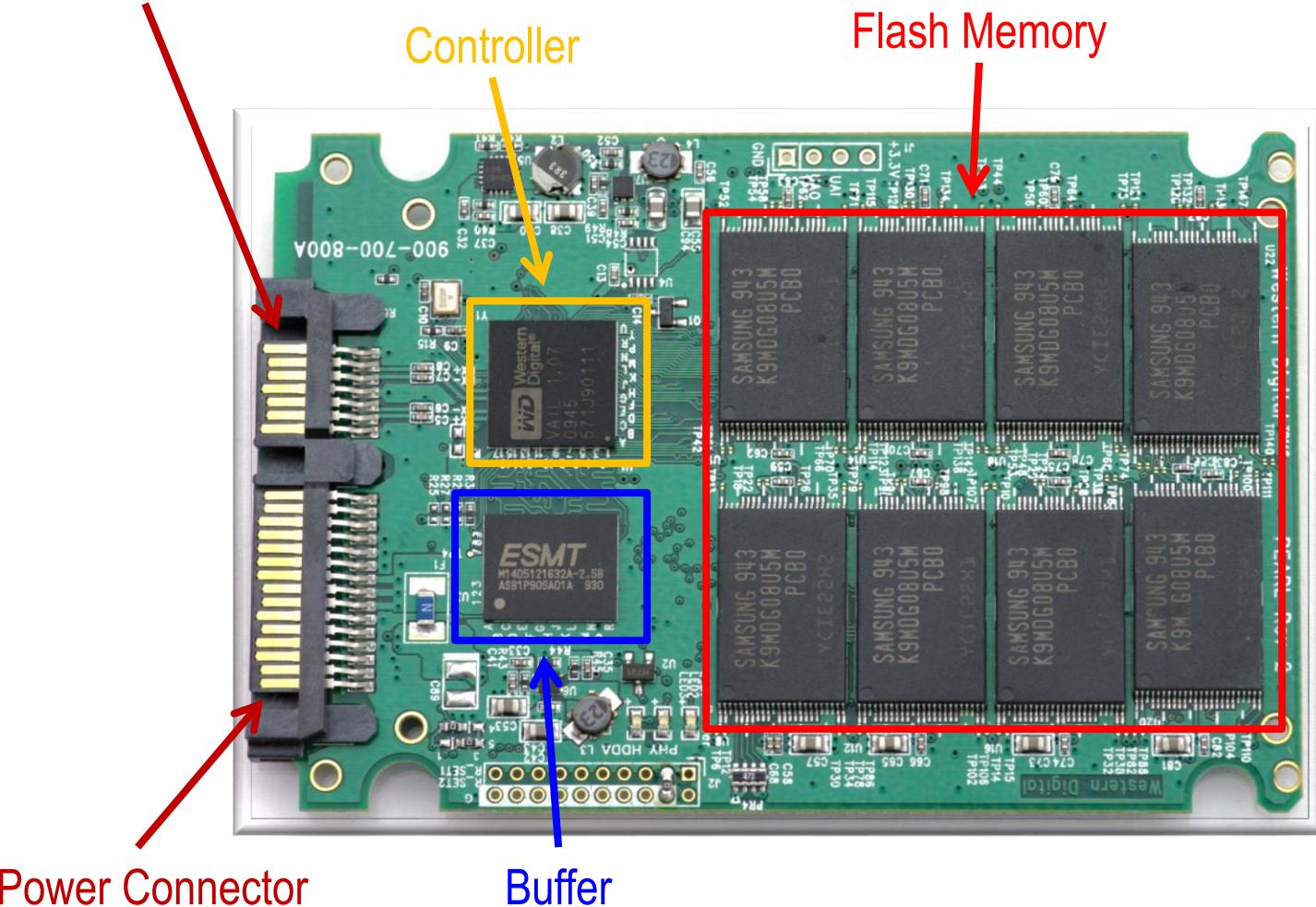


Inside an SSD

SATA Interface

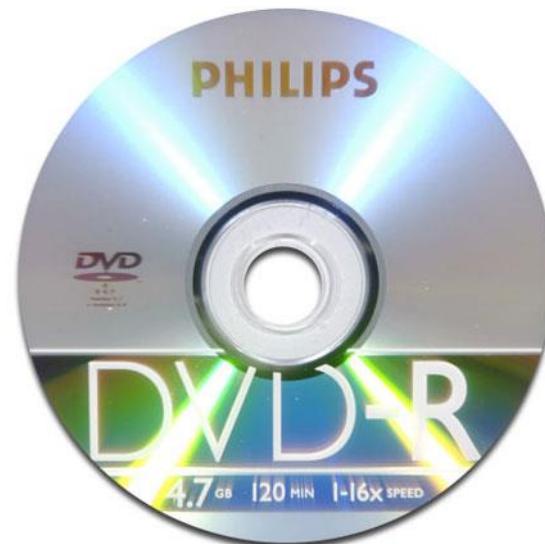
Controller

Flash Memory

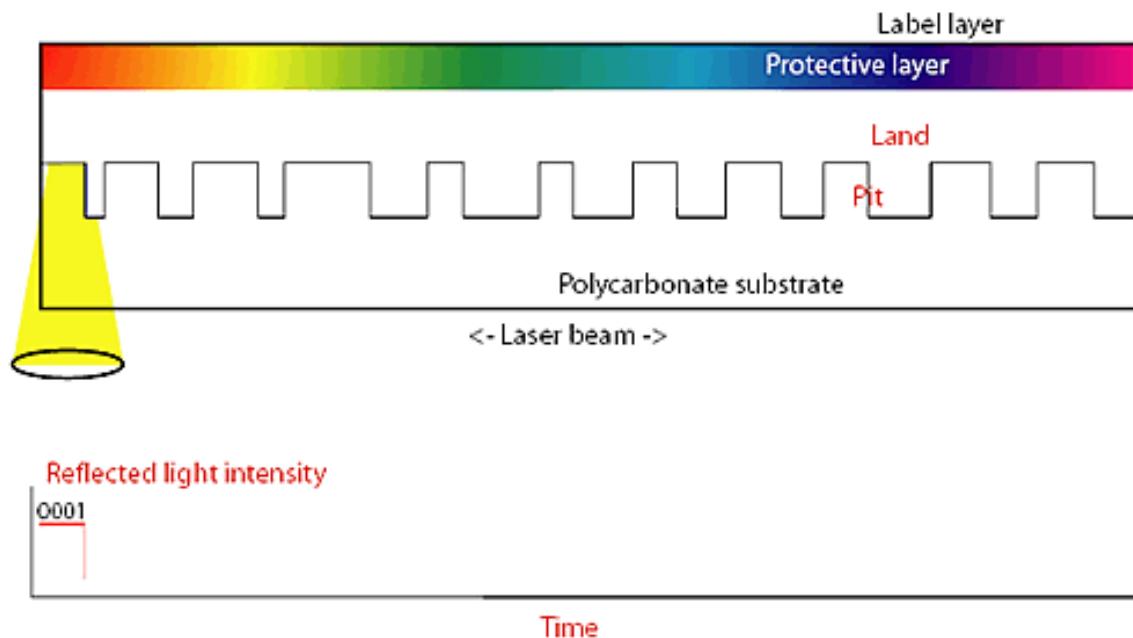


CD and DVD: Three categories of optical technologies:

- Read-Only Memory (**ROM**)
- Recordable (**R**)
- ReWritable (**RW**)



Optical disks: CD and DVD technology



Blu-ray Disc

- What's the difference between Blu-ray and DVD?

BD

Storage capacity

25-128 GB

DVD

4.7-17 GB



For the future ... Holographic Versatile Disc (HVD)

- General Electric reported (2009) that by using a micro-holographic storage material they can create capacity of **20 single-layer Blu-ray discs** or **100 DVDs** in a standard disc.
- **500 GB**



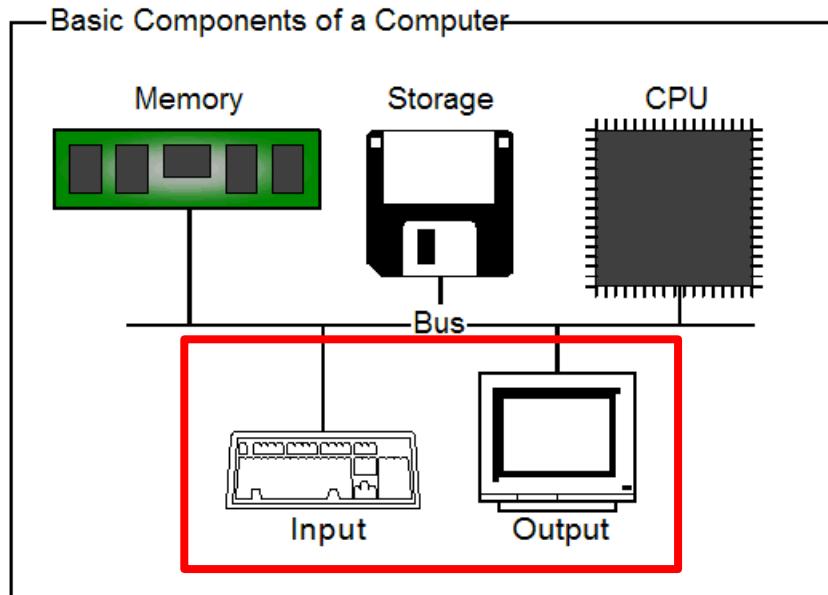
Magnetic tapes (Enterprise use)

- IBM 3592 JC/JY cartridge **4TB**



Estimated archive life: Up to 30 years

Continue about Computers



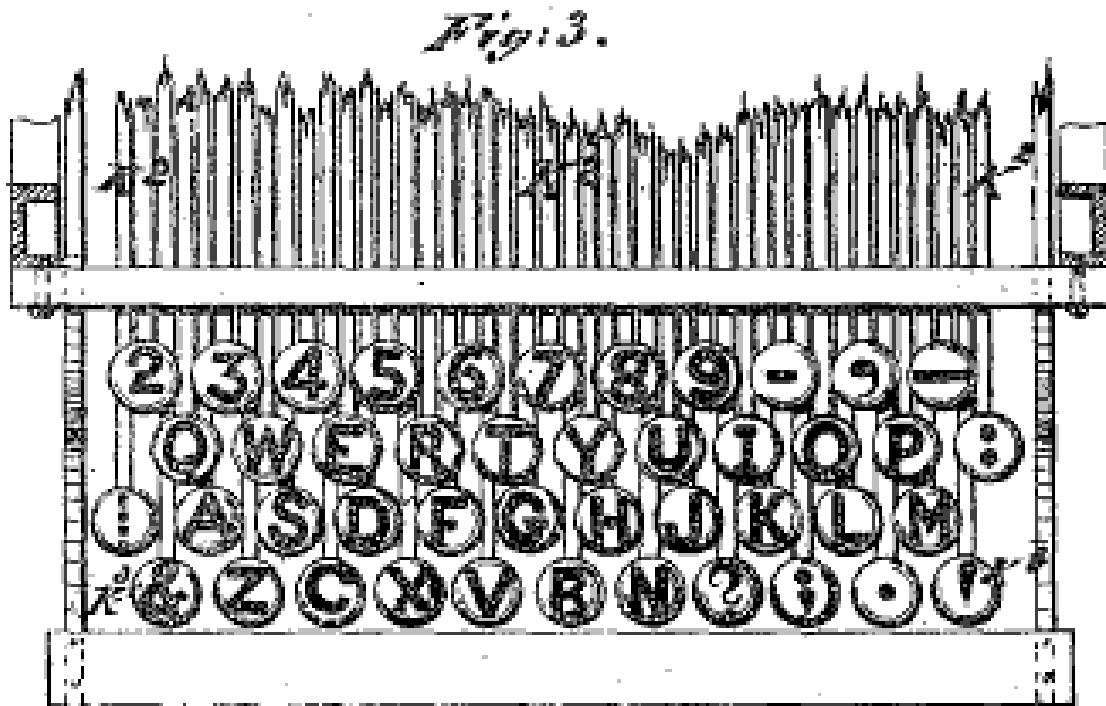
Input/Output (I/O) units

- Keyboard
- Monitor
- Mouse
- Trackball
- Scanner
- Barcode Reader
- 2D bar code reader
- Printer

QWERTY Keyboard (1874)



Christopher Sholes



QWERTY Keyboard (today)



QWERTY Keyboard



Dvorak Keyboard (1936)



Dr. August Dvorak

ABC

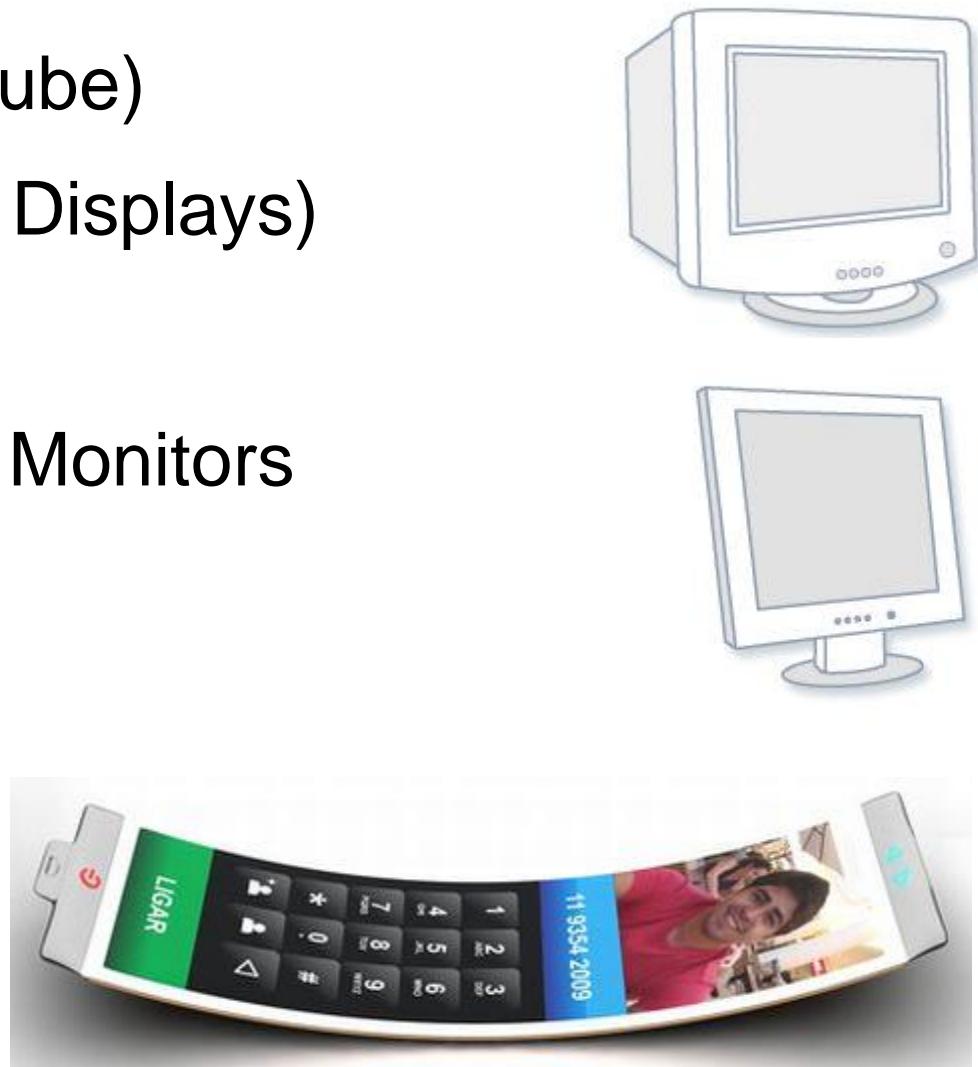
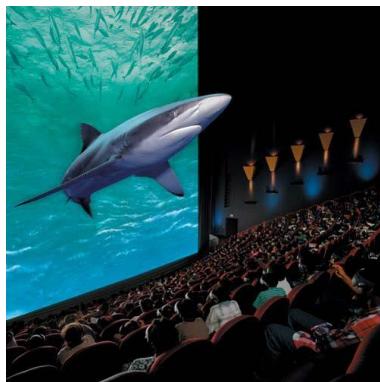


ABC



Computer monitors/TV

- CRT (Cathode-ray tube)
- LCD (Liquid Crystal Displays)
- OLED
- 3D (3-Dimensional) Monitors



Monitor size

- Monitor size is measured diagonally across the face of the monitor, from one corner to the other.
- Average screen sizes: 14", 15", 17", 19", 21", ..., 64"



Monitor Characteristics

1. Resolution
2. Dot Pitch



Resolution

- The **resolution** is related to the number of Pixels that a screen contains.
- (Pixel = Dots that make up the monitor's image)

Resolution

VGA 640 x 480

SVGA 800 x 600

XGA 1024 x 768

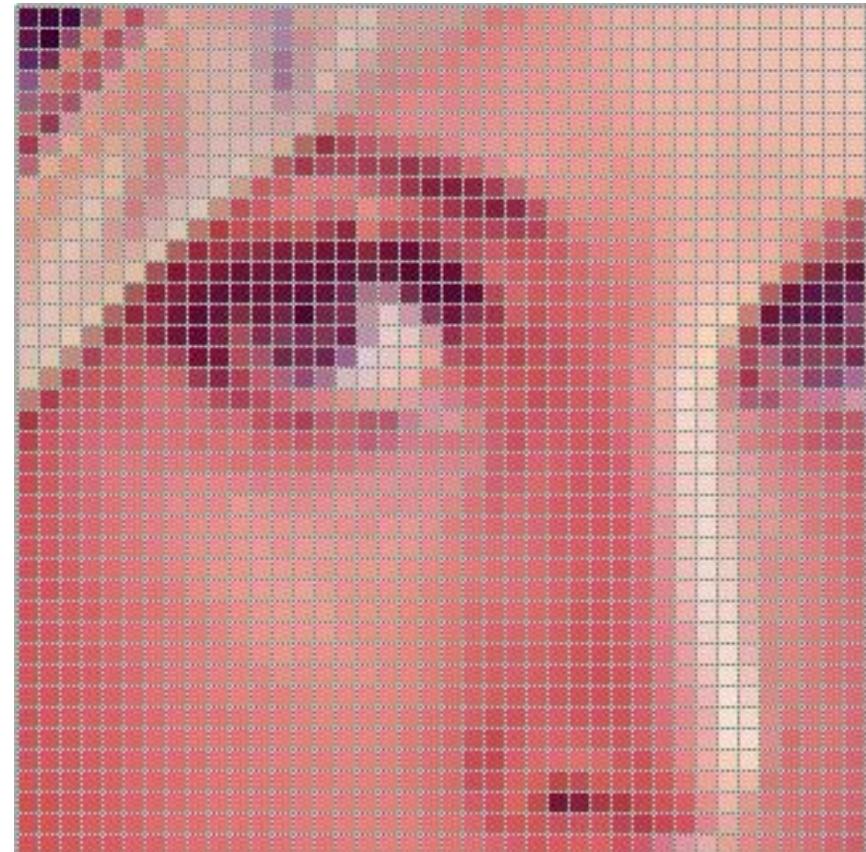
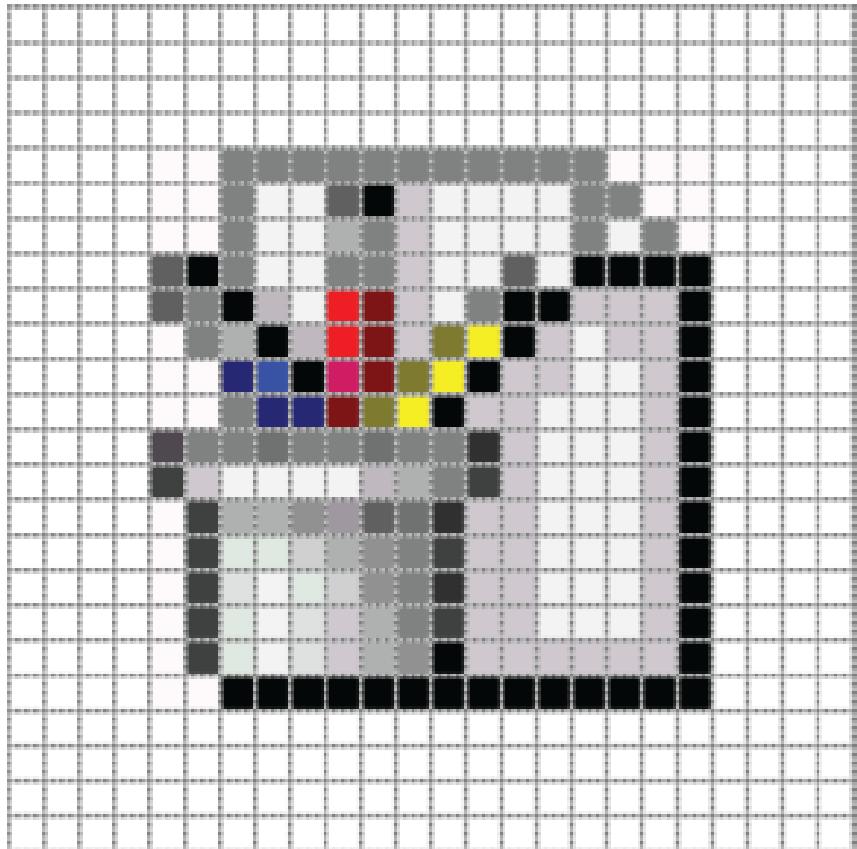
SXGA 1280 x 1024

UXGA 1600 x 1200

WUXGA 1920 x 1200

WQXGA 2560 x 1600

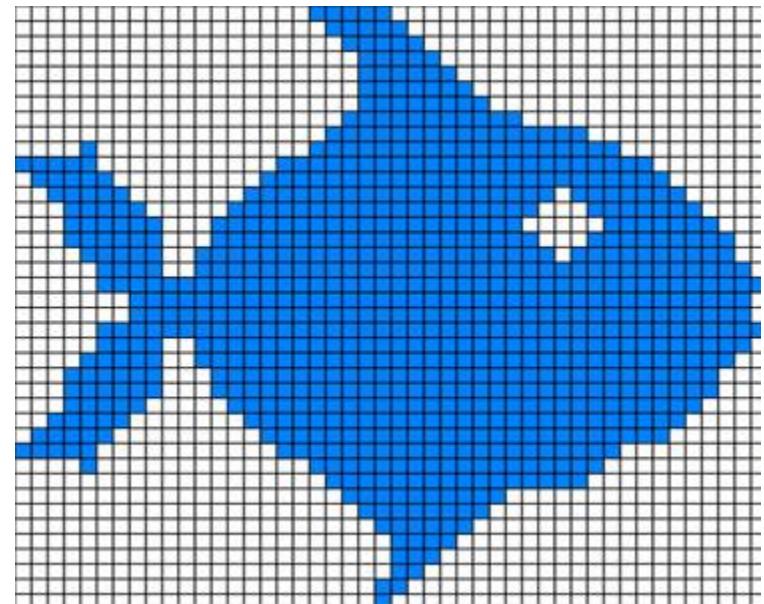
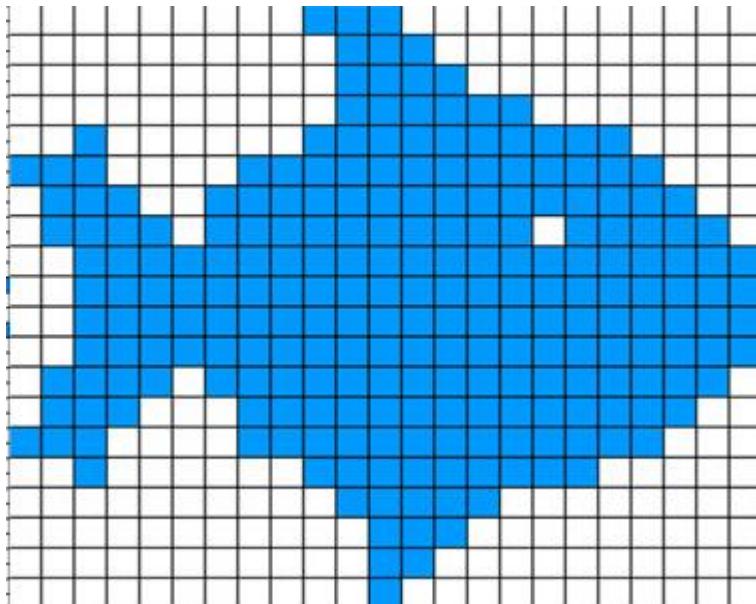
Pixels



More Pixels...

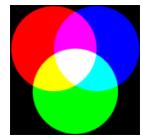
- (Pixel = Dots that make up the monitor's image)
- More Pixels = Higher resolution or more detailed image.

More pixels ... Less pixels



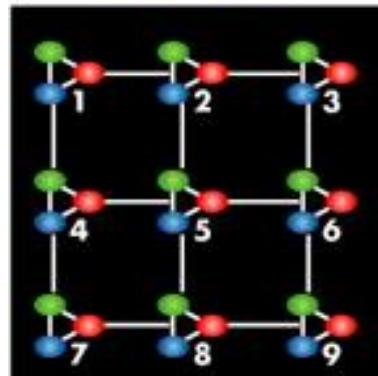
The dots that make up a graphic screen display are called?

More dots ... better imaging results
... higher resolution



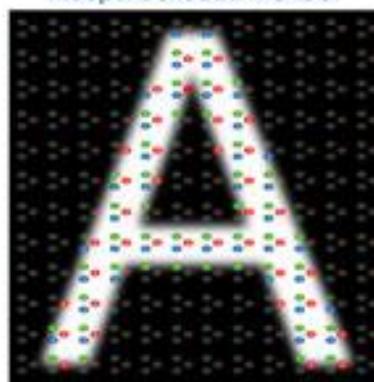
Pixels (RGB)

Daktronics
Pure Pixel™ Design

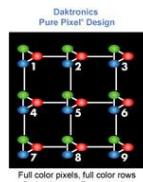
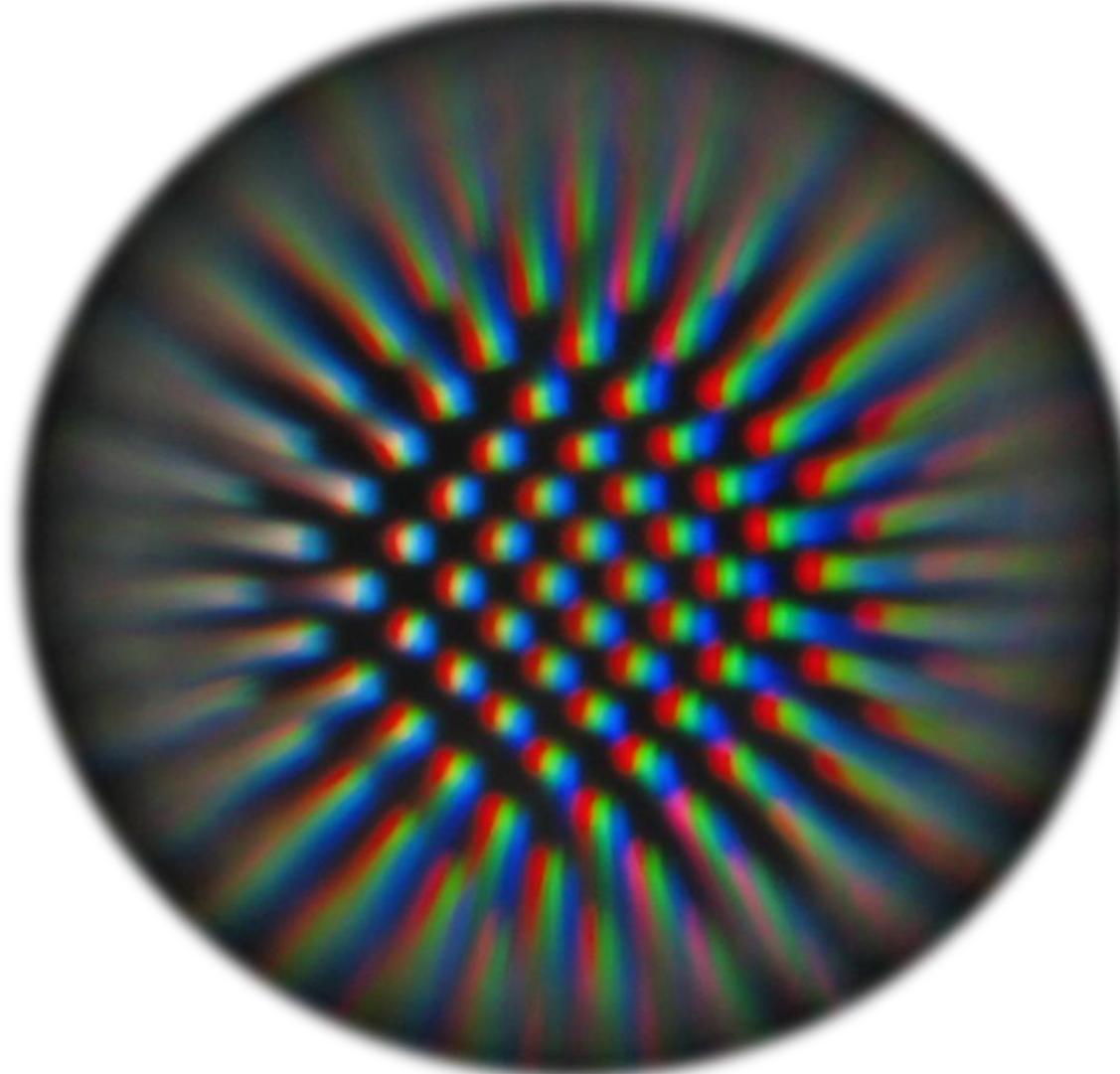


Full color pixels, full color rows
Optimal Image Reproduction

Daktronics
Independent LED Control



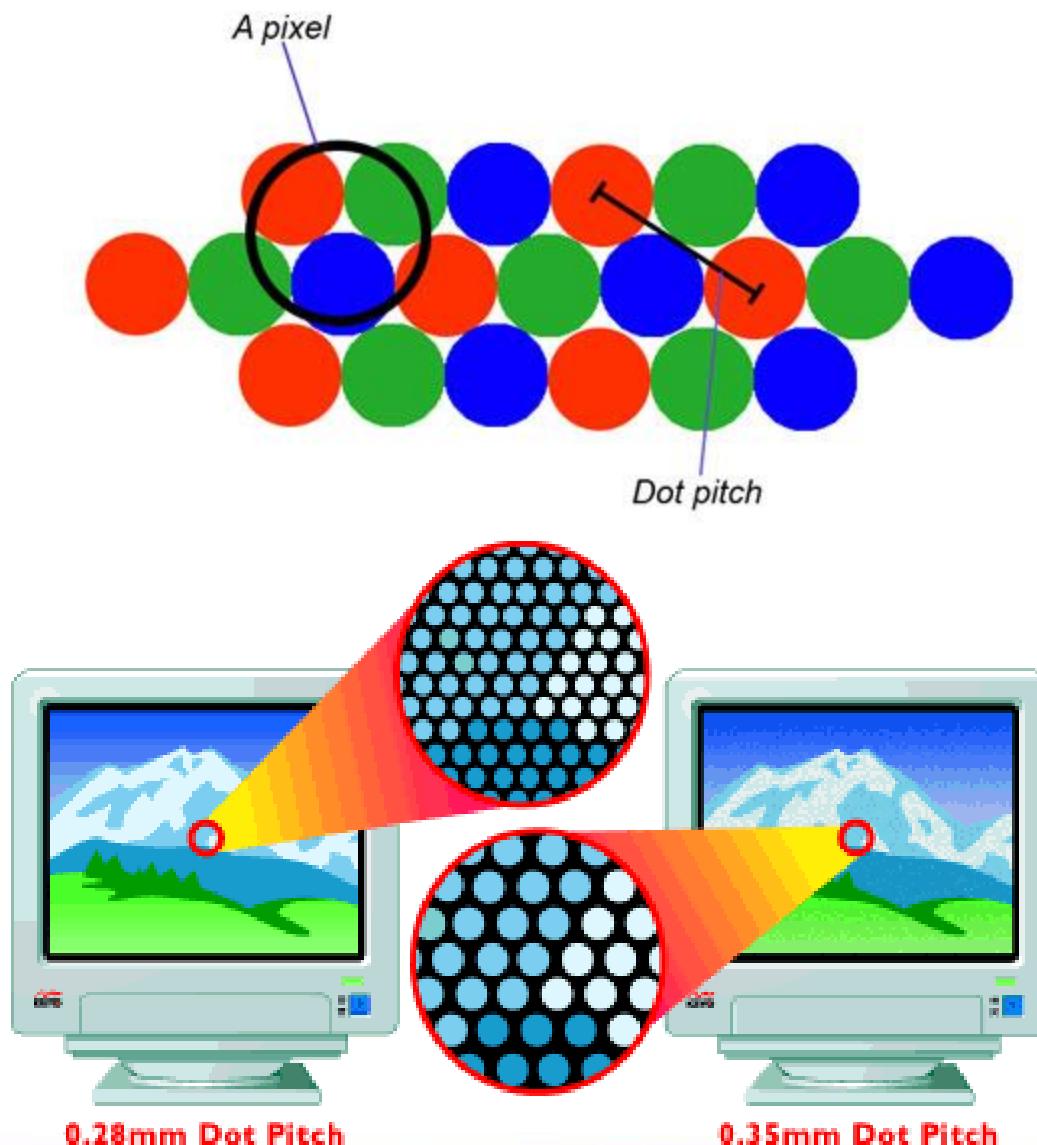
Pixels



Dot pitch (mm)

- The Dot Pitch refers to the **distance**, measured in millimeters, between the pixels.
- Typical Dot pitch = 0.25 - 0.31 mm.
- The smaller the Dot Pitch, the closer the pixels and therefore the image will be sharper.

Dot pitch (mm)



LCD monitor

- Liquid Crystal Display (LCD), a lightweight, energy-efficient display type used in flat-panel displays (TV, computers...)



LCD characteristics

- Contrast Ratio
- Response Time
- Viewing Angle

Contrast ratio-LCD

- It's a measurement of the difference between the darkest (black) and brightest (white) spot (pixel) on a display.
- Therefore ... 1000:1 contrast ratio means that a perfectly white pixel is 1000 times brighter than a perfectly black pixel.
- A typical contrast ratio today is → 1000:1
- Characteristic: For clearer images and more accurate color representation.

Contrast ratio-LCD



Low Dynamic Contrast Ratio

High Dynamic Contrast Ratio

Response time-LCD

- A measurement of how quickly a LCD monitor turns a pixel on or off
- Typical value: 3 to 5 ms ... (less response time the better)
- Eliminates blurring and streaking in fast-action scenes and video.

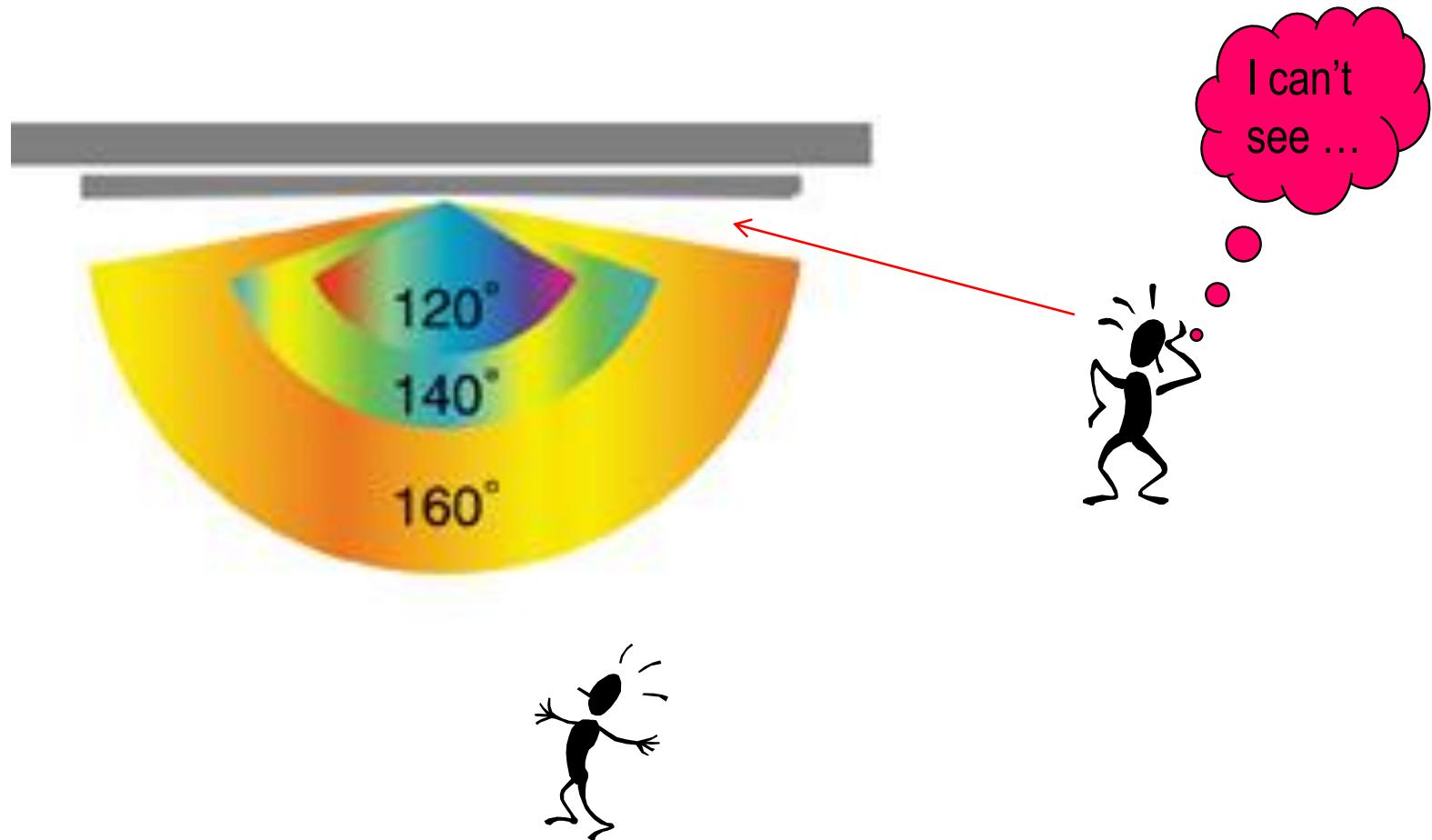
Response time-LCD



Viewing Angle-LCD

- A measurement of the range of angles at which minimum acceptable viewing parameters (contrast ratio, good brightness and front-of-screen performance) is maintained
- Measured in horizontal viewing angle (left/right) and vertical viewing angle (up/down). Typical value: 160-170 degrees
- Characteristic: Excellent color reproduction at different angles increases user flexibility.

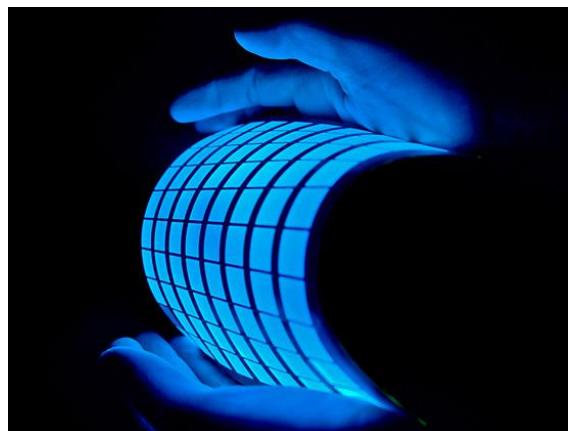
Viewing Angle-LCD



OLED

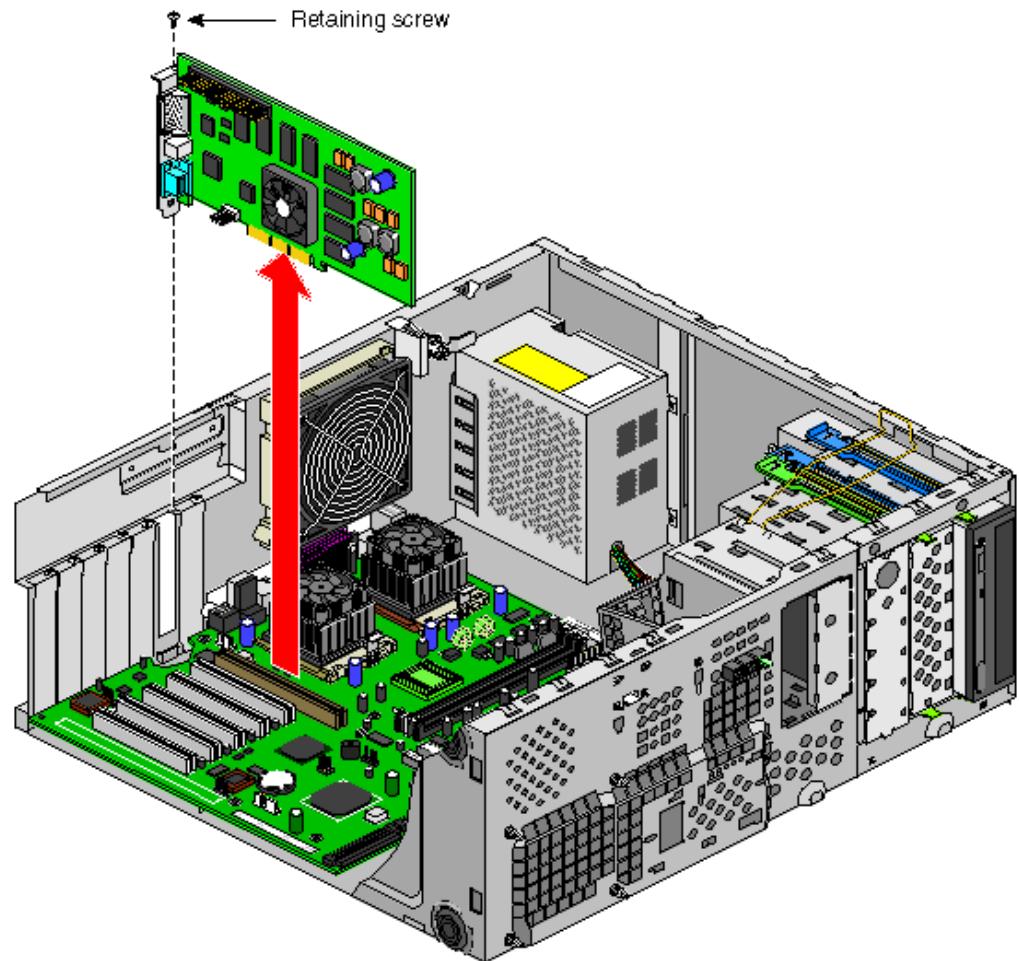
- OLED (Organic Light Emitting Diodes) is a flat display technology
- Do not require a backlight because produce light. Therefore OLED's require less power to run
- Can be made very-very thin.

OLED



Expansion Cards

- ... are used to add functionality to a computer.
- Examples include:
 - Video card
 - Sound card
 - Modem
 - Network (NIC)
 - And others...

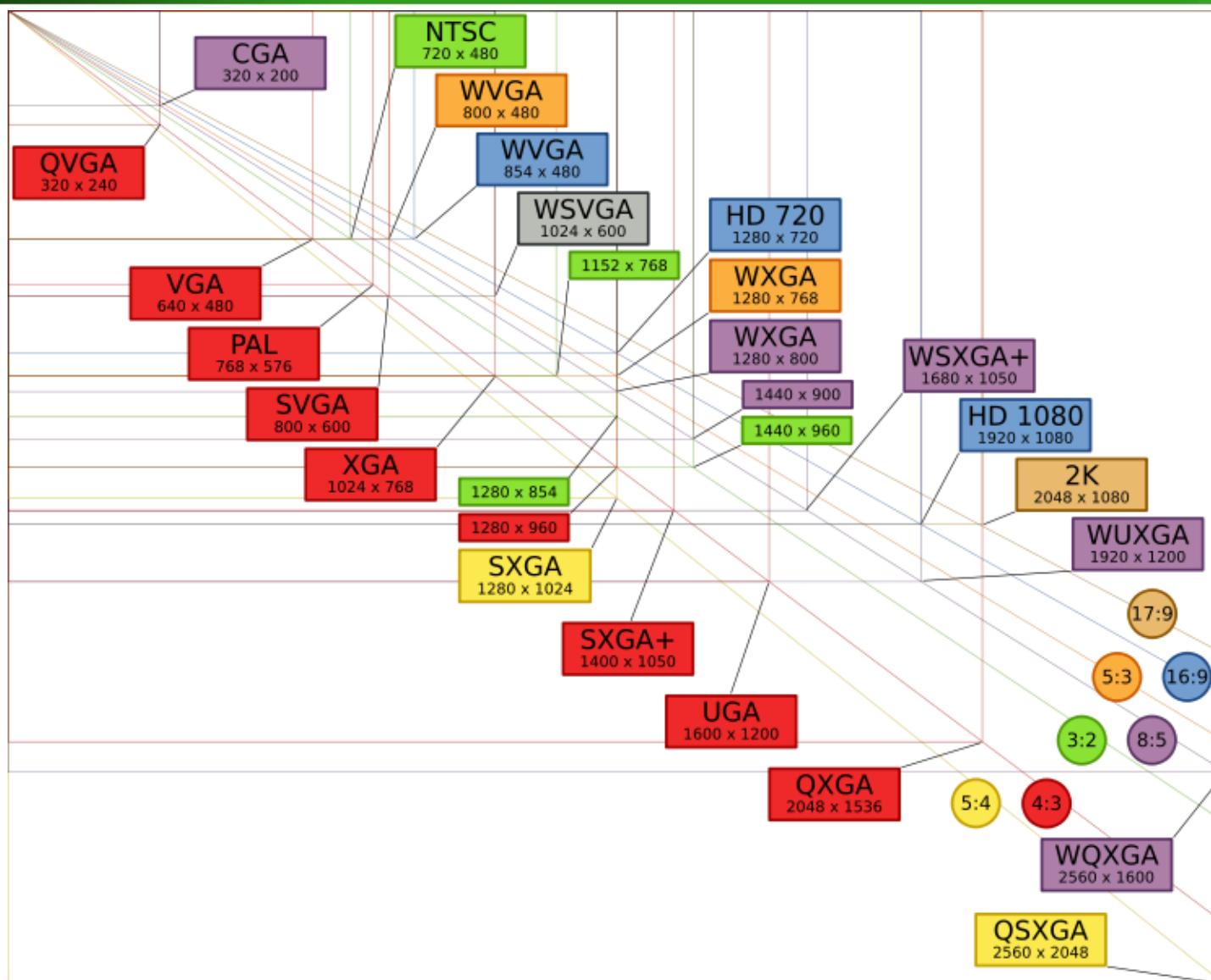


Example of expansion card

- Graphics Card or Video card
- Processes data to output information to the screen
- Video Cards typically contain **Graphics Processing Unit (GPU)**.

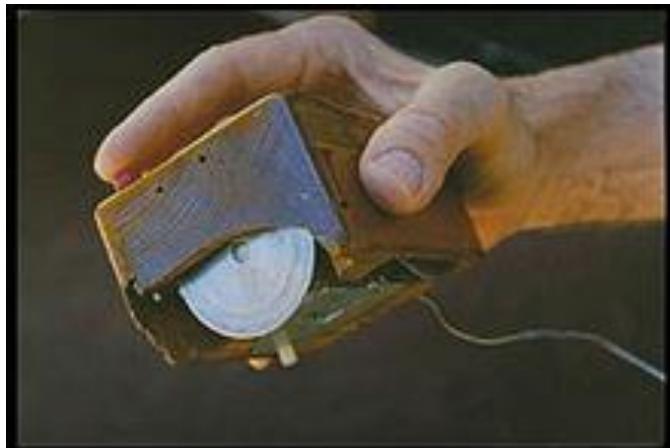


Video Standards



Mouse

- The Mouse is an electronic pointing device
- Operates by moving a ball underneath a palm-size maneuverable case that is attached to the computer system
- Mouse operation = Point and click.



The first computer mice was invented by Douglas Engelbart in 1963 with the help of his colleague Bill English.



Trackball

- Similar electronic device with the mouse...



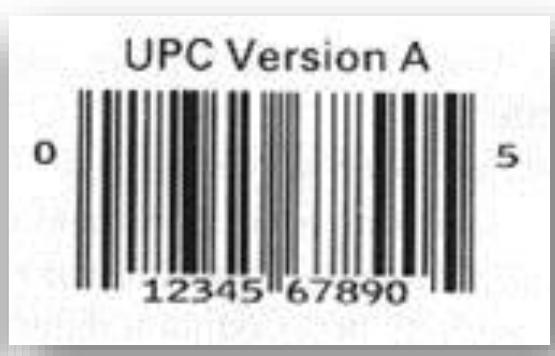
Scanner – input device

- Electronic device that is used to *input* text, figures, photos etc., into the memory of a computer system
- (The scanner translates: text, figures, photos into data).



Barcode Reader

- It is used to scan Universal Product Codes (**UPC**)
- (The zebra-striped symbols now carried on nearly all products).



2D barcode reader

- Reads 2D matrix bar codes
- Used in manufacturing IDs, USPS.



Printers

- ❖ Impact
- ❖ Non-impact
- ❖ Plotters.

Impact

- Dot-matrix printer



Non-Impact

- Laser printer
- InkJet (bubble-Jet) printers
- Thermal transfer printers; for colors
- Snapshot printers; thermal for photos, less expensive



Plotters

- Large printers; Architecture drawing



Computer Systems

Computer Systems

- ❖ Personal Computers

- Desktop
- Laptop
- Tablet (lightweight, portable)

- ❖ Parallel Computers

Tablet Devices

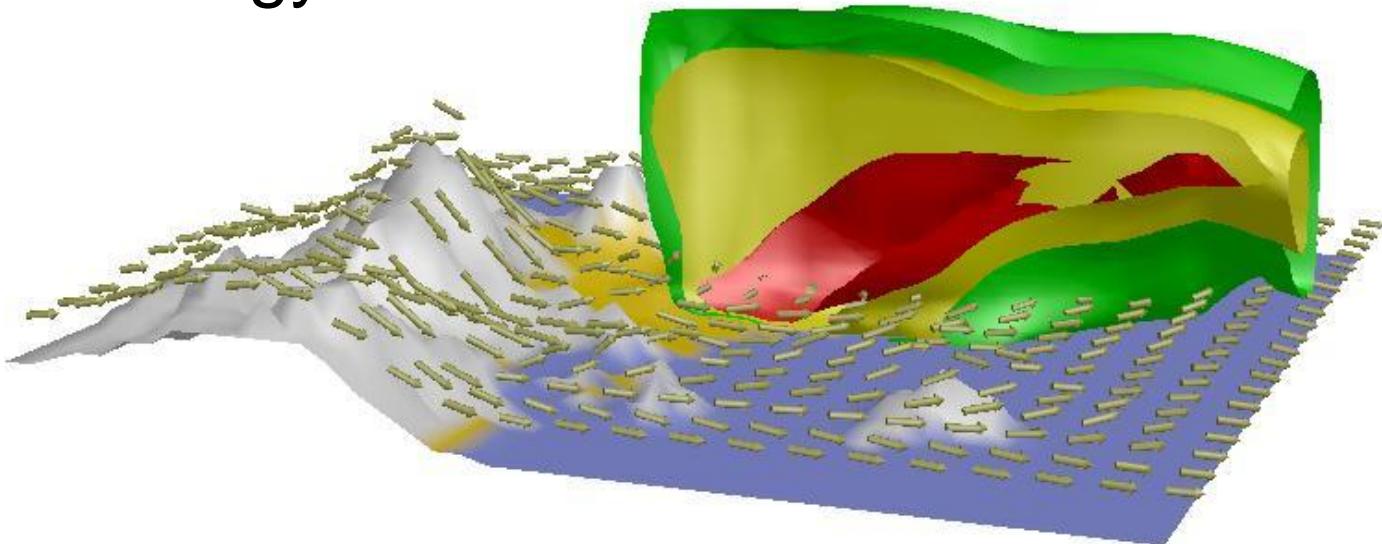


Parallel Computers

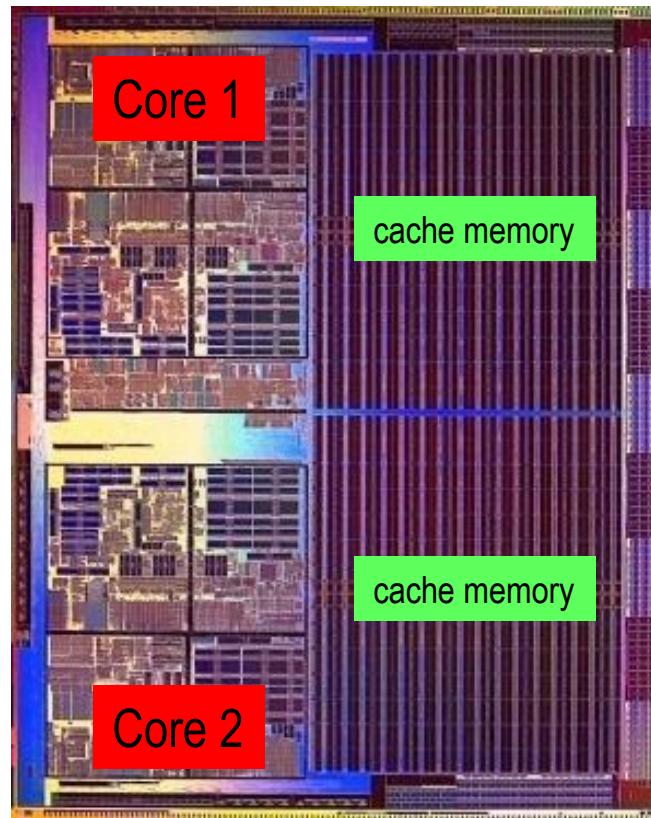
- In the case where we use more than one computer or CPU (core) to solve a problem ... this computer system is called ...
- ... PARALLEL COMPUTER.

Applications of Parallel Computers

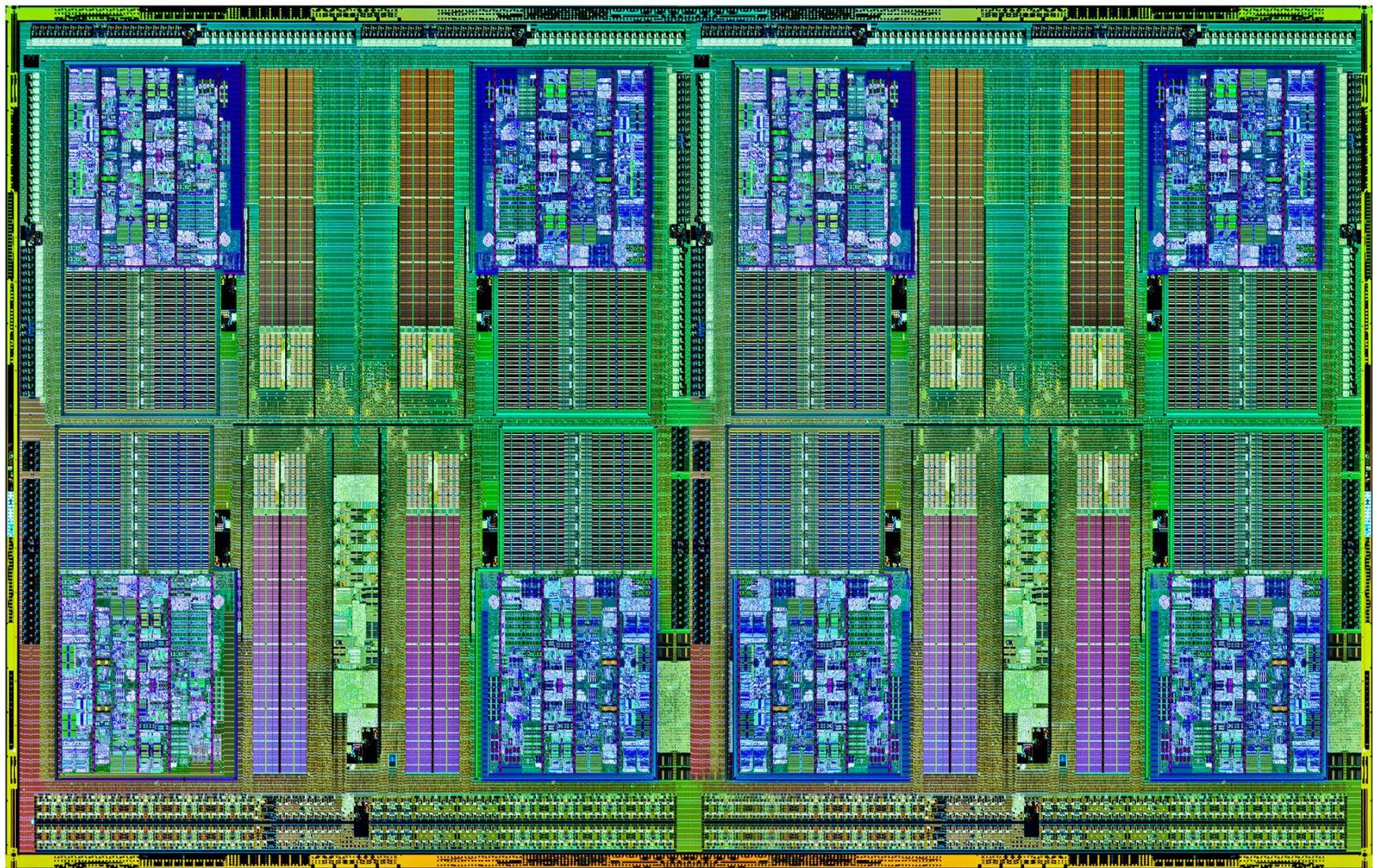
- Meteorology
- Cosmology
- Defense systems
- Fuel cell technology
- ...



Dual Core (CPU) Computers



16 Core AMD; Opteron 6300



Tianhe-2 (MilkyWay-2)

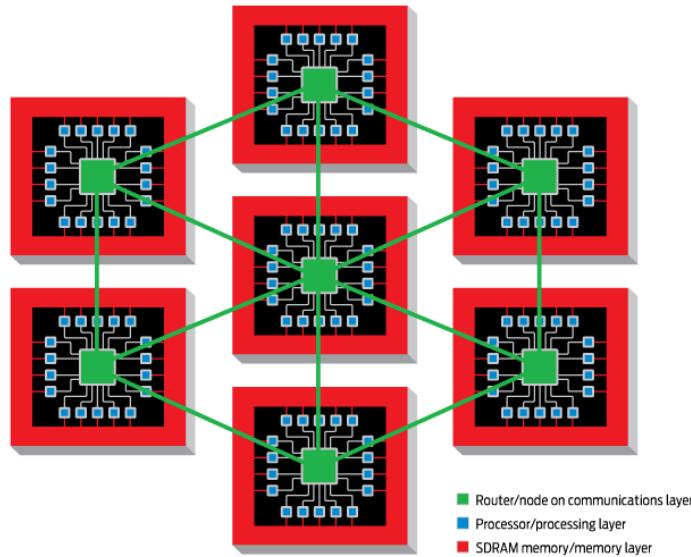
- The most powerful (massively) parallel computer (developed by NUDT [China])
Cores: 3,120,000 [Intel Xeon E5-2692v2 12C 2.2GHz]





Parallel Processing

- Method of improving the processing [computational] speed of a computer system using more than one processor (CPU)
- **Parallel Processing**



Next lecture...

Computer Communication/Networks