

INPUT and OUTPUT
ORGANIZATION
in COMPUTER
ARCHITECTURE

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MODERN I/O DEVICES

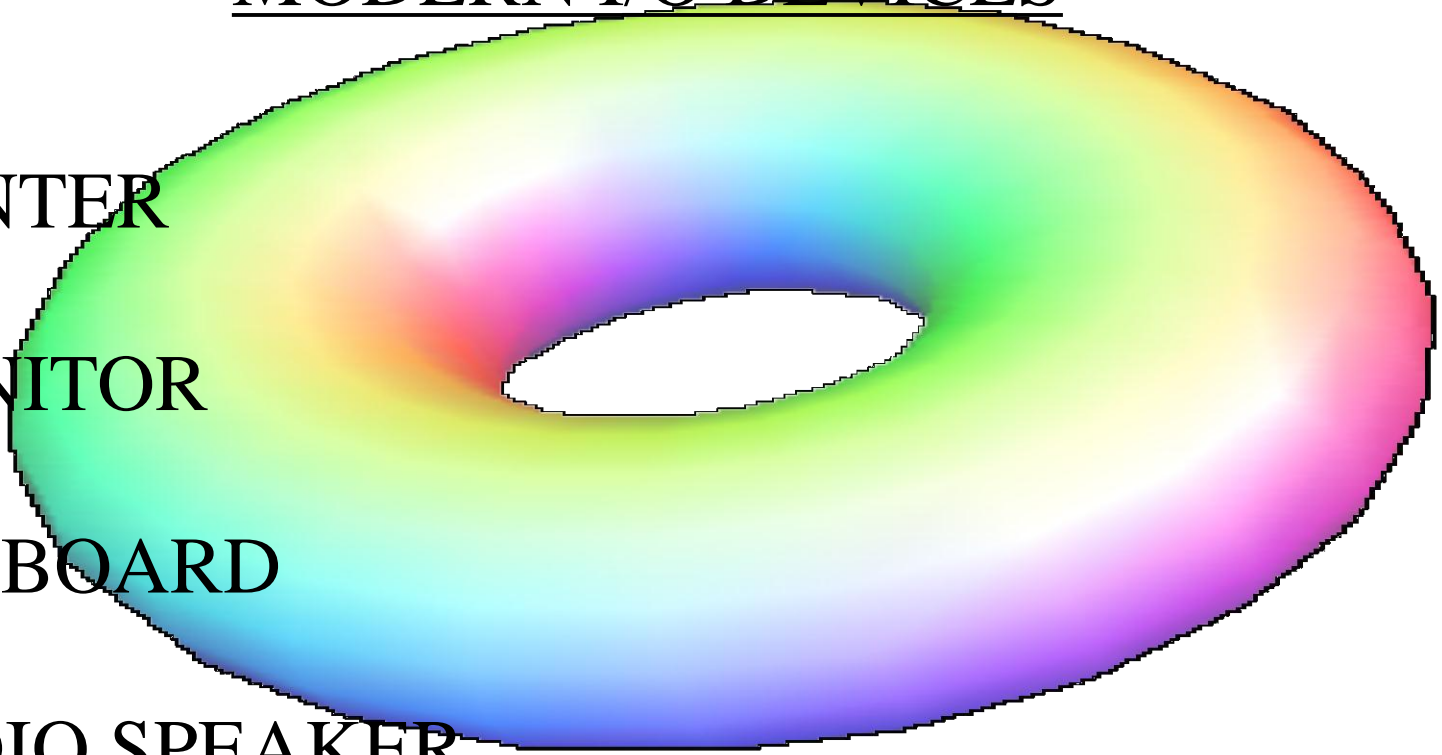
1. PRINTER

2. MONITOR

3. KEYBOARD

4. AUDIO SPEAKER

5. DVD DRIVE



INPUT AND OUTPUT PORTS

1. USB Port
2. Parallel Port
3. Serial Port

SYNCHRONIZATION

To prevent problems, programmed I/O relies on *synchronization*.

That is, once it issues a command, the processor must interact with the device to determine when the device is ready for another command.

POLLING

The basic form of synchronization that a processor uses with an I/O device is known as *polling*.

How does software perform polling ?
By using a *fetch* operation.

INTERRUPT-DRIVEN I/O

1. I/O device hardware
2. Bus architecture and functionality
3. Processor architecture
4. Programming Paradigm

The INTERRUPT

How does the processor know which device is interrupting ?

The processor uses the bus to find out.

Interrupt vector :

a pointer to software that handles the device

How are values installed in an interrupt vector table ?

Software must initialize interrupt vectors because neither the processor nor the device hardware enters or modifies the table.

To overcome the differences in devices, architects have introduced a modification of the interrupt scheme that provides *multiple level interrupts*.

How are interrupt assignments made ?

There are 2 answers :

- a) Fixed, manual assignment used on small, embedded systems
- b) Flexible, automated assignment used on general-purpose systems

DIRRECT MEMORY ACCESS (DMA)

Direct memory access (DMA) :
a smart I/O device that can transfer data into memory directly.

A device that uses DMA can transfer data between the device and memory without using the processor.

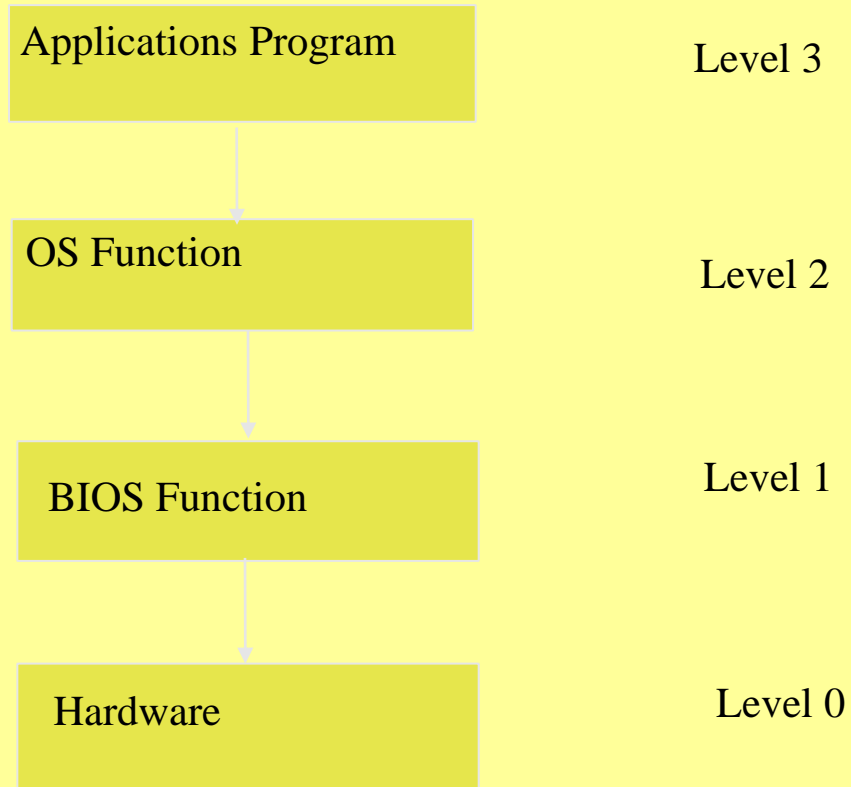
INPUT-OUTPUT PROCESSOR (IOP)

An input-output processor (IOP) may be classified as a processor with direct memory access that can communicate with I/O devices.

Processors that communicate directly with I/O devices are also called *data channels*.

A processor that communicates with remote terminals over telephone wires and other communication media is called a *data communication processor*.

ACCESS LEVELS FOR I/O OPERATIONS



FULL-DUPLEX and HALF-DUPLEX INTERACTION

Interface hardware uses 2 methods to accommodate bidirectional transfer :

1. Full-duplex interaction
2. Half-duplex interaction

KEYBOARD

A computer keyboard is an array of switches, each of which sends the PC a unique signal when pressed.

Two types of switch are commonly used:

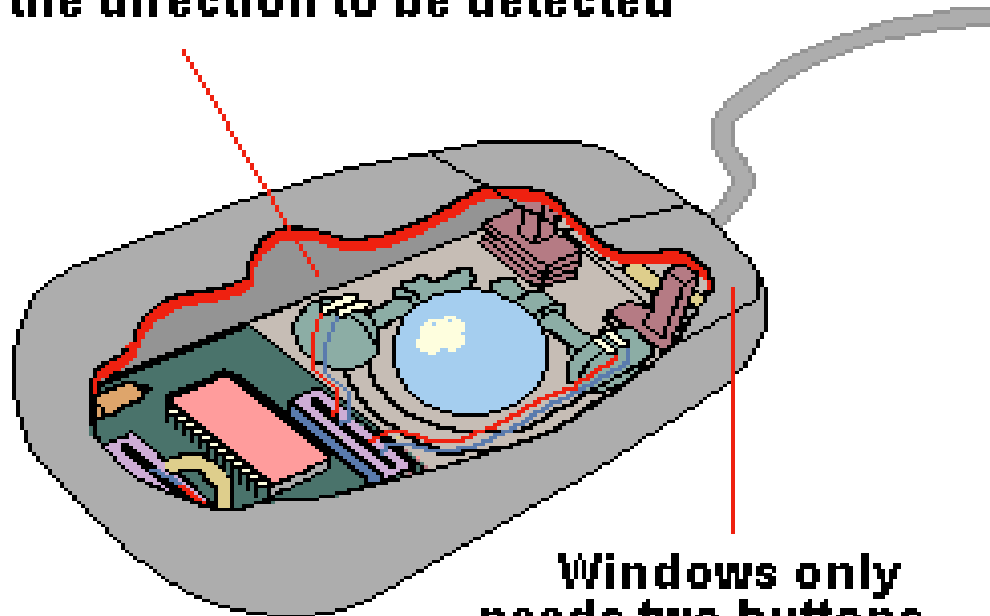
- 1) mechanical
- 2) rubber membrane.

MICE

The commonest mouse used today is opto-electronic.

Also inside the mouse are a switch for each button, and a microcontroller which interpret the signals from the sensors and the switches, using its firmware program to translate them into packets of data which are sent to the PC.

**Two sensors on each wheel
allow the direction to be detected**



**Windows only
needs two buttons,
other operating systems use three**

TOUCHSCREEN

A touchscreen is an intuitive computer input device that works by simply touching the display screen, either by a finger, or with a stylus, rather than typing on a keyboard or pointing with a mouse.

Built-in touchscreens are internal, heavy-duty touchscreens mounted directly onto the CRT tube.

The touchscreen interface - whereby users navigate a computer system by touching icons or links on the screen itself - is the most simple, intuitive, and easiest to learn of all PC input devices and is fast becoming the interface of choice for a wide variety of applications, such as:

- Public Information Systems
- Restaurant/POS Systems
- Customer Self-Service
- Control / Automation Systems
- Computer Based Training

Subsequently, several types of touchscreen technologies have emerged, each with its own advantages and disadvantages that may, or may not, make it suitable for any given application:

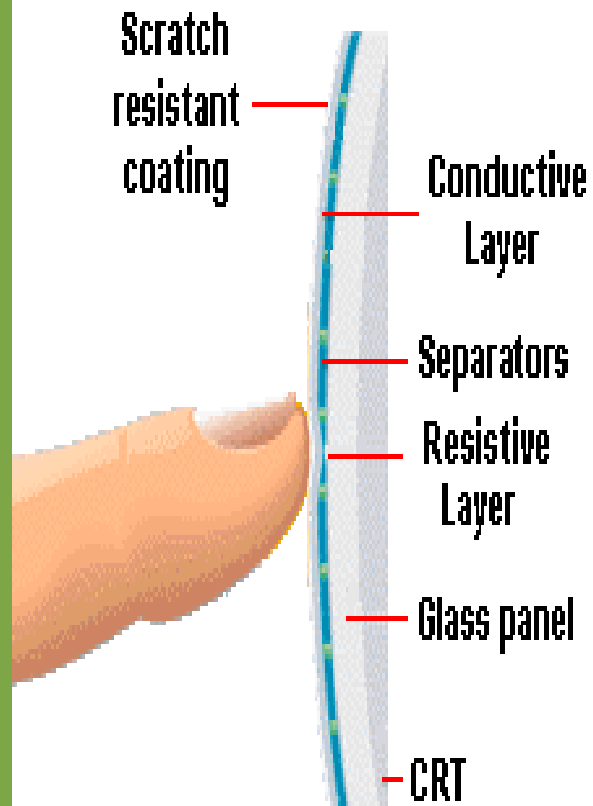
a) Resistive

b) Infrared

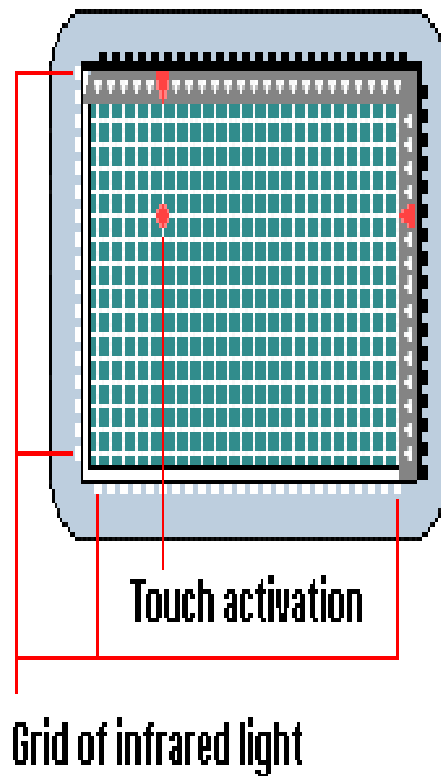
c) Surface Acoustic Wave

d) Capacitive

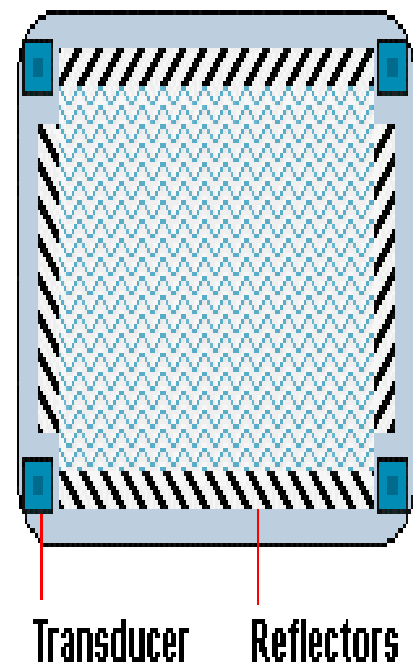
Resistive



Infrared

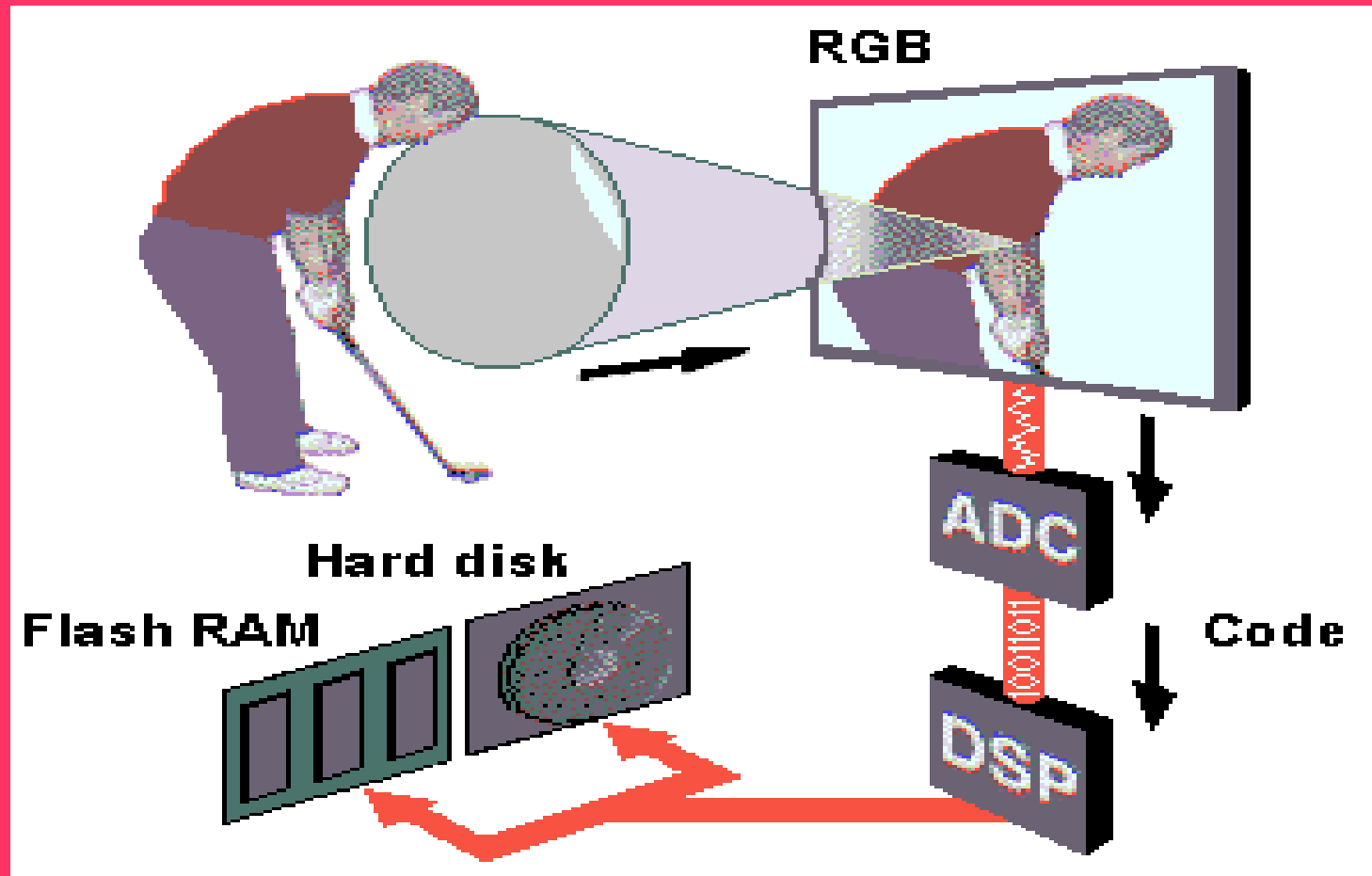


Surface Acoustic Wave



DIGITAL CAMERA

In principal, a digital camera is similar to a traditional film-based camera. There's a viewfinder to aim it, a lens to focus the image onto a light-sensitive device, some means by which several images can be stored and removed for later use, and the whole lot is fitted into a box.



SUMMARY

Computer systems interact with external devices either to control the device or to transfer data.

The I/O aspect of architecture means a connection between a computer and the external world.

REFERENCES

1. <http://www.pctechguide.com>
2. Comer, Douglas. *Essentials of Computer Architecture*. 2005. Prentice Hall.
3. Irvine, Kip. *Assembly Language for INTEL-BASED COMPUTERS*. 2003. Prentice Hall.

