Lecture-3

Topics:
- computers classification

- Introduction to Microprocessors
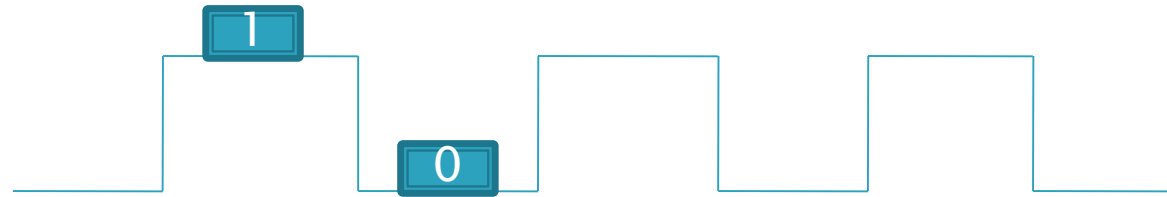
1. COMPUTERS CLASSIFICATION ACCORDING TO DATA REPRESENTATION TECHNIQUES

According to DRT ,computers can be classified into three types

computers		
Digital	Analog	Hybrid

Digital computers

A computer that stores data in terms of digits (numbers) and proceeds in discrete steps from one state to the next.

1

0

Digital computers have the capabilities of adding, subtracting, multiplying ,dividing and comparing. These computers provide highly accurate results.
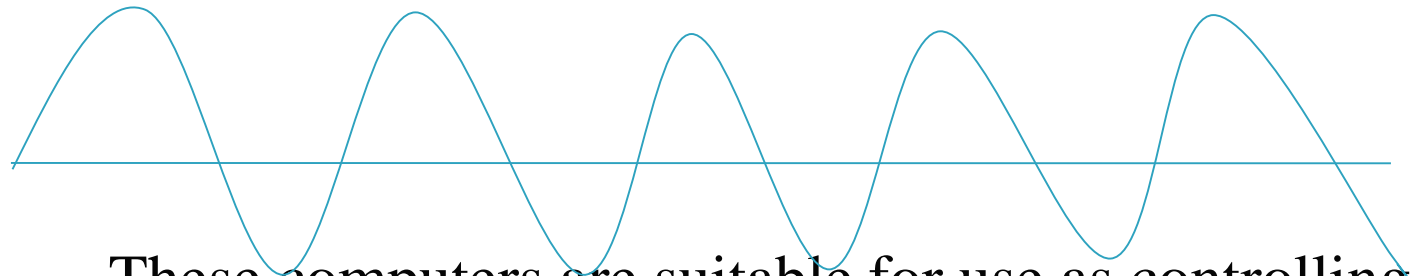
For example:

I. Desk Calculators

II. Electronic computers

Analog computers

A computer that represents data in terms of physical measures or quantities and proceeds along a continuum constituted by its components

These computers are suitable for use as controlling devices in factories ,military weaponry.

For example:

Speedometer

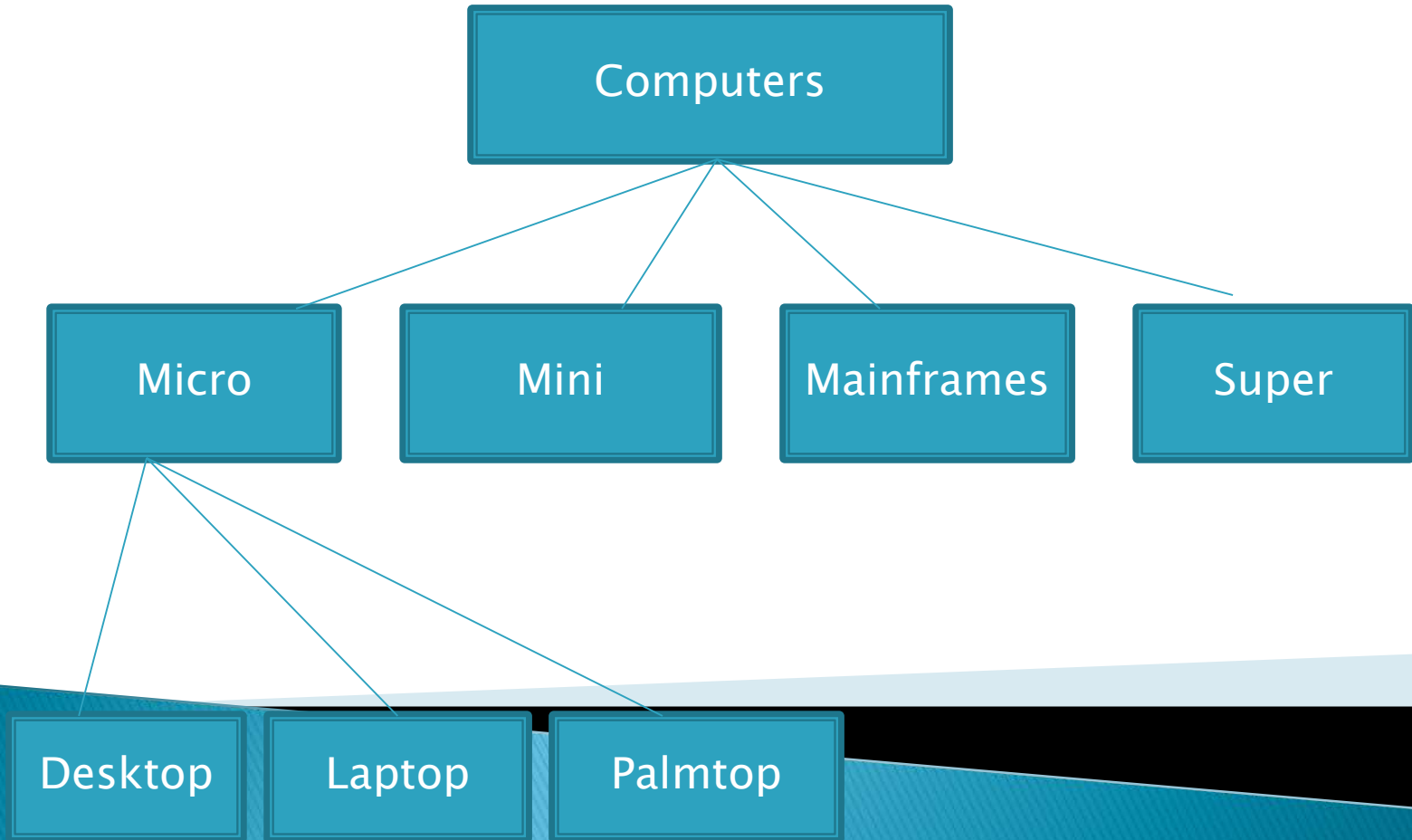Voltmeters

Wall clock

Flight simulators

Hybrid computers

Hybrid computers are computers that comprise features of analog computers and digital computers. The digital component normally serves as the controller and provides logical operations, while the analog component normally serves as a solver of differential equations.

For example:

Intensive care unit (I.C.U)

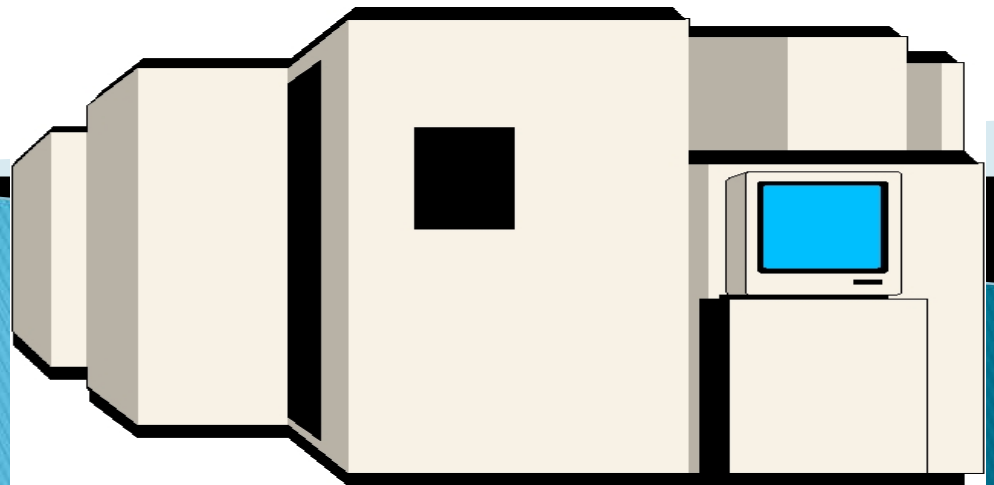# 2. Computer classification by capacity performance criteria (by size, cost, speed & memory)

```
                    ┌─────────────┐
                    │  Computers  │
                    └─────────────┘
          ┌───────────┬──────┴──────┬───────────┐
     ┌────────┐  ┌────────┐   ┌────────────┐  ┌────────┐
     │ Micro  │  │  Mini  │   │ Mainframes │  │ Super  │
     └────────┘  └────────┘   └────────────┘  └────────┘
      ┌───┴────┬─────────┐
 ┌─────────┐ ┌────────┐ ┌─────────┐
 │ Desktop │ │ Laptop │ │ Palmtop │
 └─────────┘ └────────┘ └─────────┘
```

Super computers

➢ The biggest in size

➢ the most expensive in price

➢ It can process trillions of instructions in seconds.

➢ This computer is not used as a PC in a home neither by a student in a college.

➢ Governments specially use this type of computer for their different calculations and heavy jobs.

➢ In most of the Hollywood's movies it is used for animation purposes.

➢ This kind of computer is also helpful for forecasting weather reports worldwide.

Mainframe computer

➤This can also process millions of instructions per second and is capable of accessing billions of data.

➤This computer is commonly used in big hospitals, air line reservation companies, and many other huge companies prefer mainframe because of its capability of retrieving data on a huge basis.

➤This is normally to expensive

➤This kind of computer can cost thousands of dollars

Mini computers

➤ Mini computers generally have greater size, main and secondary memories and powerful processor.

➤ It is capable of supporting from 4 to about 200 simultaneous users.

➤ It is commonly used as a server in the network environment.

➤ Mini computers are usually multi-user systems so they are used in interactive applications in industries, research organizations, colleges, and universities.

Micro computers

➢A micro computer is a small and low cost digital computer

➢Which usually consists of a microprocessor, a storage unit, a power supply, appropriate peripherals.

➢They are mainly used for managing personal data of a small company or an individual. that's why they are called (PC).

Introduction to Microprocessor

Microprocessor, the key component, the brain, of a computer

its various sub-systems

- ✓ Bus interface unit
- ✓ Data & instruction cache memory
- ✓ Instruction decoder
- ✓ Arithmetic-Logic unit
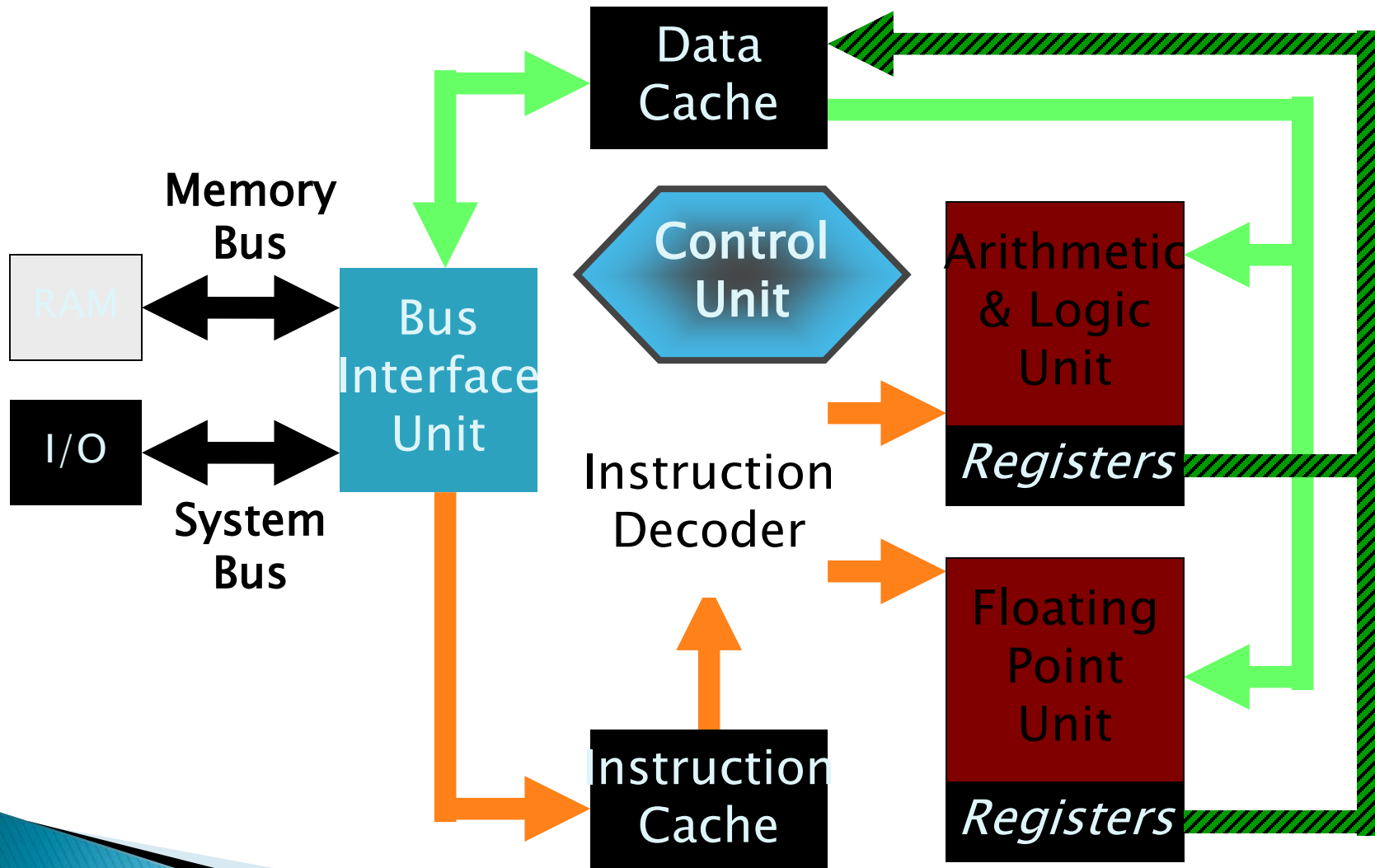- ✓ Floating-point unit
- ✓ Control unit

Microprocessor

❑ The key element of all computers, providing the mathematical and decision making ability

❑ Current state-of-the-art uPs (Pentium, Athlon, SPARC, PowerPC) contain complex circuits consisting of tens of millions of transistors

❑ They operate at ultra-fast speeds – doing over a billion operations very second

❑ Made up from a semiconductor, Silicon

Integrated Circuits

- Commonly known as an IC or a chip

- A tiny piece of Silicon that has several electronic parts on it

- Most of the size of an IC comes form the pins and packaging; the actual Silicon occupies a very small piece of the volume

- The smallest components on an IC are much smaller than the thickness of a human hair

Microprocessor

Bus Interface Unit

❑Receives instructions & data from main memory

❑Instructions are then sent to the instruction cache, data to the data cache

❑Also receives the processed data and sends it to the main memory

Instruction Decoder

❑This unit receives the programming instructions and decodes them into a form that is understandable by the processing units, i.e. the ALU or FPU

❑Then, it passes on the decoded instruction to the ALU or FPU

Arithmetic & Logic Unit (ALU)

It performs whole-number math calculations (subtract, multiply, divide, etc) comparisons (is greater than, is smaller than, etc.) and logical operations (NOT, OR, AND, etc)

Floating-Point Unit (FPU)

Also known as the "Numeric Unit"

It performs calculations that involve numbers represented in the scientific notation (also known as floating-point numbers).

Floating-point calculations are required for doing graphics, engineering and scientific work

Registers

Both ALU & FPU have a very small amount of super-fast private memory placed right next to them for their exclusive use. These are called registers

The ALU & FPU store intermediate and final results from their calculations in these registers

Processed data goes back to the data cache and then to main memory from these registers

Control Unit

The brain of the uP

Manages the whole uP

Tasks include fetching instructions & data, storing data, managing input/output devices

That was the structure, now let's talk about the language of a uP

Instruction Set

✓The set of machine instructions that a uP recognizes and can execute – the only language uP knows

✓An instruction set includes low-level, a single step-at-a-time instructions, such as add, subtract, multiply, and divide

✓Each uP family has its unique instruction set

✓Bigger instruction-sets mean more complex chips (higher costs, reduced efficiency), but shorter programs

Microprocessor Generations

First generation: 1971–78

Behind the power curve
(16-bit, <50k transistors)

Second Generation: 1979–85

Becoming "real" computers
(32-bit , >50k transistors)

Third Generation: 1985–89

Challenging the "establishment"
(Reduced Instruction Set Computer/RISC,
>100k transistors)

Fourth Generation: 1990–

Architectural and performance leadership
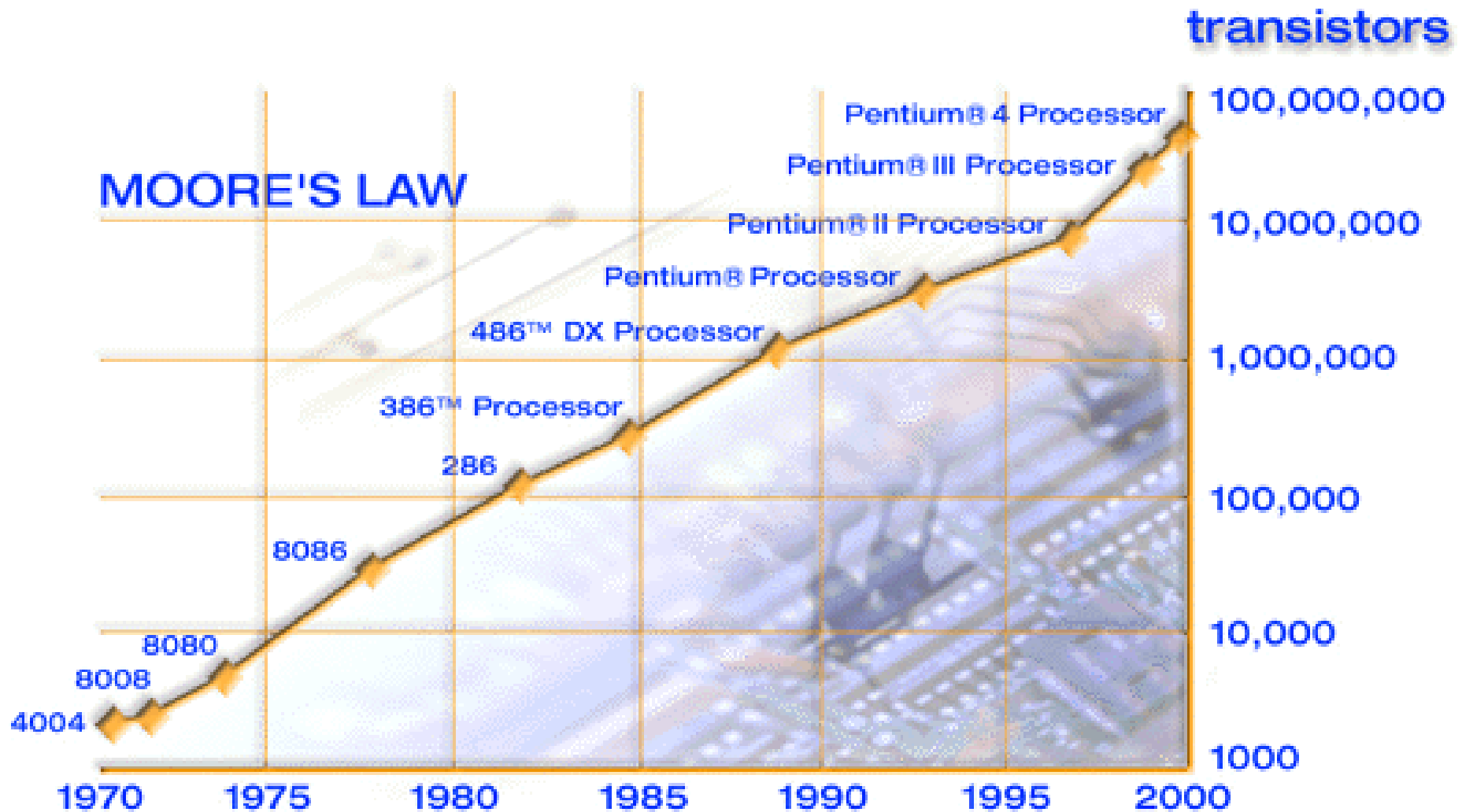(64-bit, > 1M transistors,
Intel/AMD translate into RISC internally)

Moore's Law

In 1965, one of the founders of Intel – Gordon Moore – predicted that the number of transistor on an IC (and therefore the capability of microprocessors) will double every year. Later he modified it to 18-months

His prediction still holds true in '02. In fact, the time required for doubling is contracting to the original prediction, and is closer to a year now
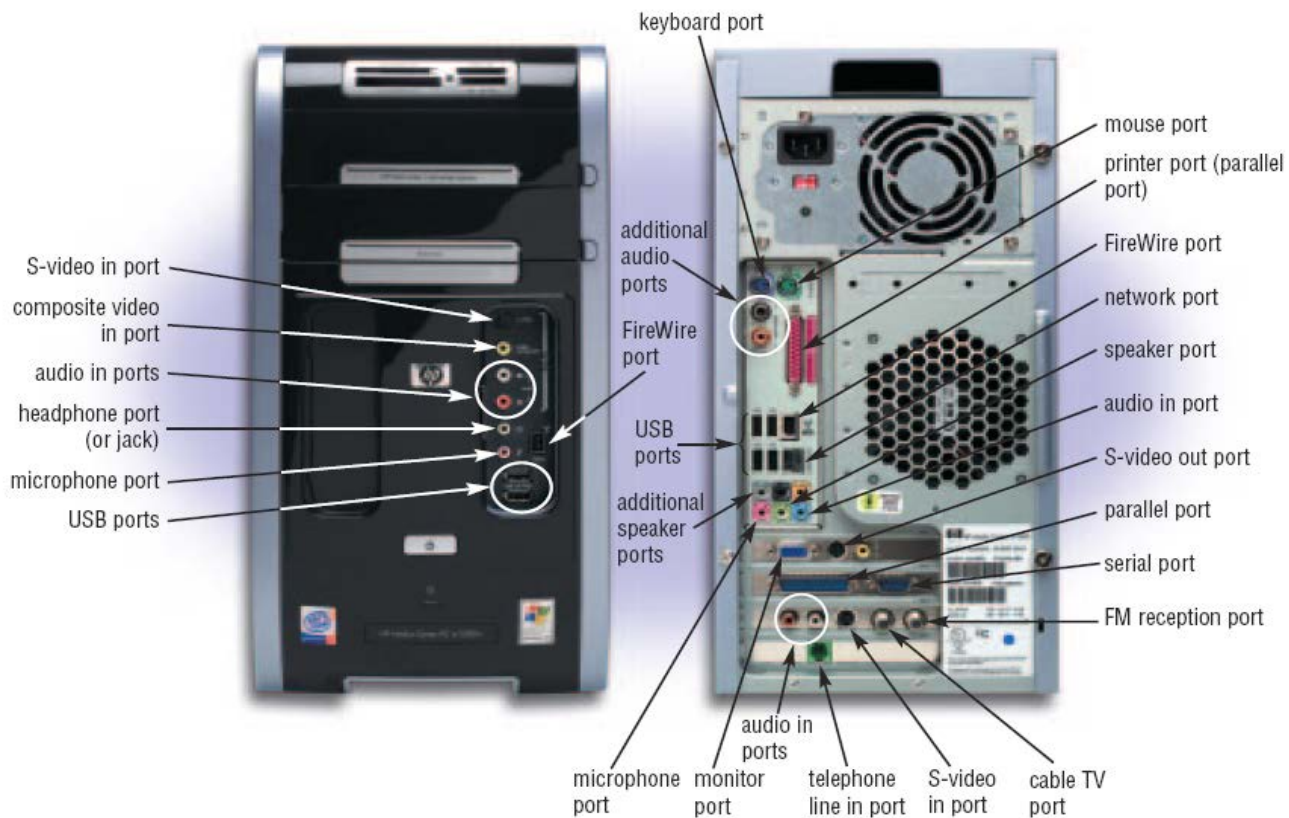
Evolution of Intel Microprocessors

Ports and Connectors

❑ **What are ports and connectors?**

➢ Port connects external devices to system unit

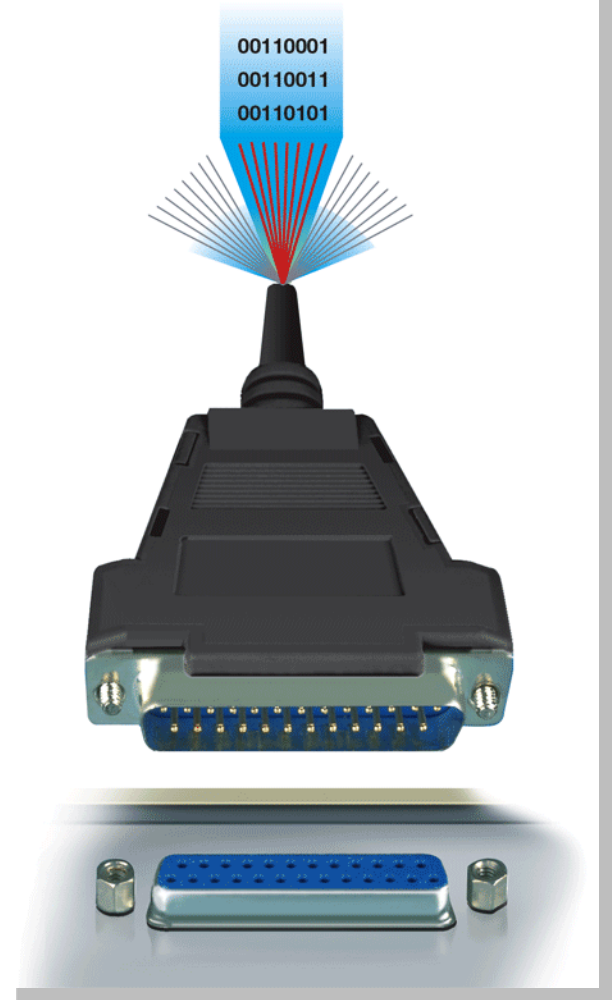➢ Connector joins cable to peripheral

Ports and Connectors

❑ **What is a serial port?**

➢ Transmits one bit of data at a time

➢ Connects slow-speed devices, such as a mouse, keyboard, or modem

Ports and Connectors

□ **What is a parallel port?**

➢ Connects devices that can transfer more than one bit at a time, such as a printer

00110001
00110011
00110101

Ports and Connectors

❑ **What are USB ports?**

USB (**u**niversal **s**erial **b**us) **port can connect up to 127 different peripherals together with a single connector type**

PCs typically have six to eight USB ports on front or back of the system unit

Single USB port can be used to attach multiple peripherals using a USB hub

The latest version of USB is called USB 2.0

Ports and Connectors

❑ **What are FireWire ports?**

➢ Connects multiple types of devices that require faster data transmission speeds
➢ Allows you to connect up to 63 devices together

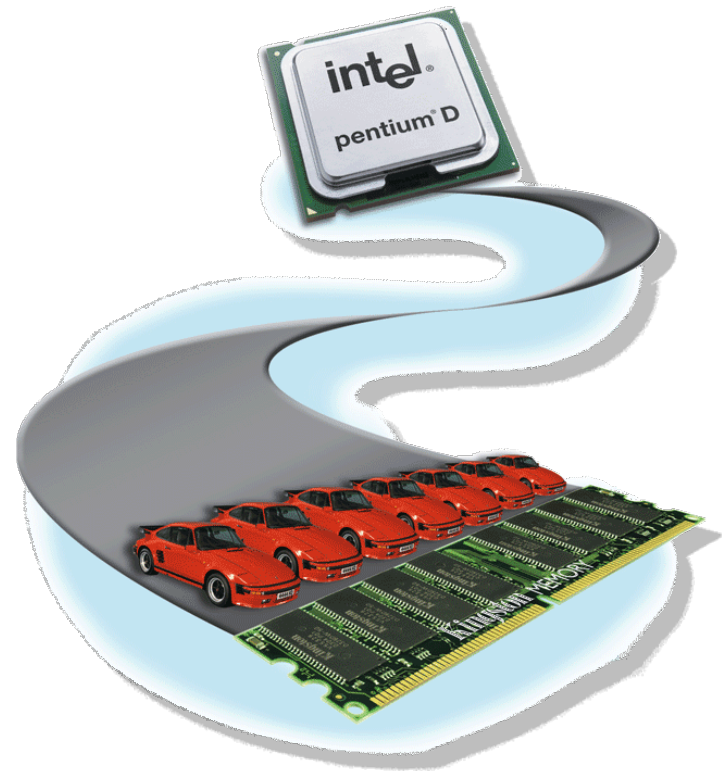# Ports and Connectors

❑ **What are special-purpose ports?**

➢ Allow users to attach specialized peripherals or transmit data to wireless devices

- MIDI (Musical Instrument Digital Interface) port
    - Serial port
    - Electronic Keyboard
- SCSI (small computer system interface) port
    - Disk Drives, Printers
- IrDA (Infrared Data Association) port
    - Smart phone, PDA, keyboard
- Bluetooth port
    - Uses radio-waves
    - Cell Phones
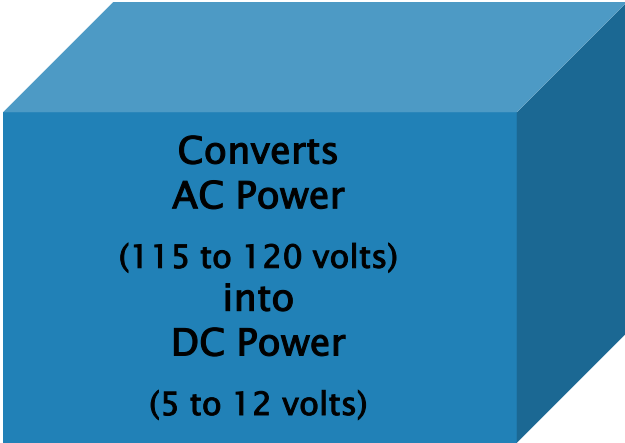
Ports and Connectors

❑ **What is a bus?**

➤ Channel that allows devices inside and attached to the computer to communicate with each other

- ▪ **Bus width (size) determines number of bits transmitted at one time**
- ▪ **64-bit common type**
- ▪ **2 Types:**
  1. **System bus connects processor and main memory**
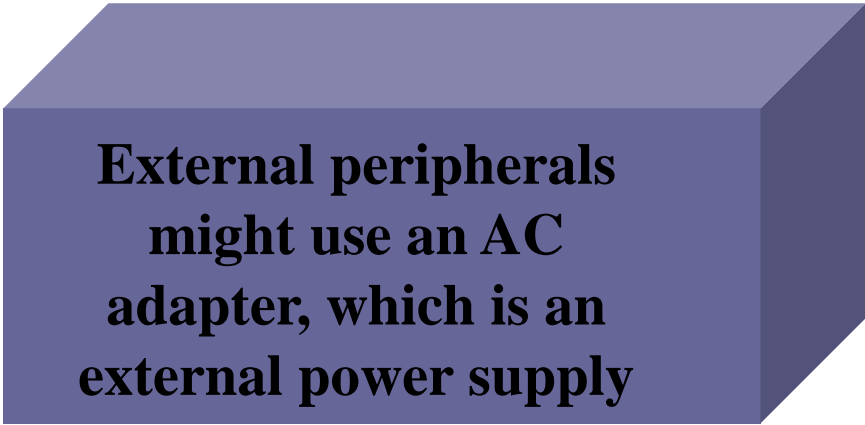 2. **Expansion bus allows processor to communicate with peripherals.**

Power Supply

❑**What is a power supply?**

Converts
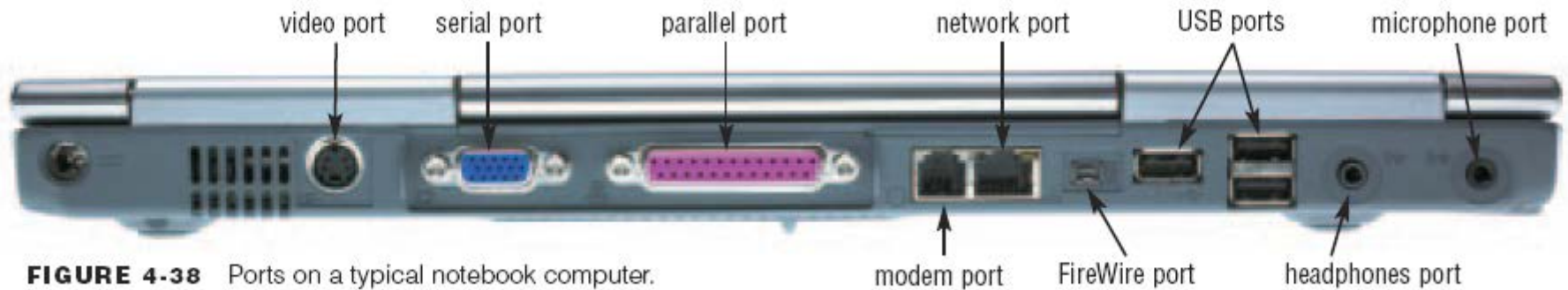AC Power
(115 to 120 volts)
into
DC Power
(5 to 12 volts)

Fan keeps system unit components cool

External peripherals might use an AC adapter, which is an external power supply

What ports are on a notebook computer?

FIGURE 4-38   Ports on a typical notebook computer.

video port   serial port   parallel port   network port   USB ports   microphone port

modem port   FireWire port   headphones port

What ports and slots are on a tablet PC?