Computer Fundamentals

Lecture_1

Aim

Aims and objectives of this course include the following:

- to understand fundamentally the general scope of the computer system
- to interact effectively with the computer
- to know the uses of the basic components of the computer
- to manage the system to some extent before involving an expert
- to know some basic things about the computer and the world

Computer and its uses

Computer and its uses

- A computer is an electronic device, operating under the control of instructions stored in its own memory.
- These instructions tell the machine what to do. The computer is capable of accepting data (input), processing
- data arithmetically and logically, producing output from the processing, and storing the results for future use.
- Most computers that sit on a desktop are called Personal Computers (PCs).

Basic Computer

Figure 2.1 *Components of a digital computer*
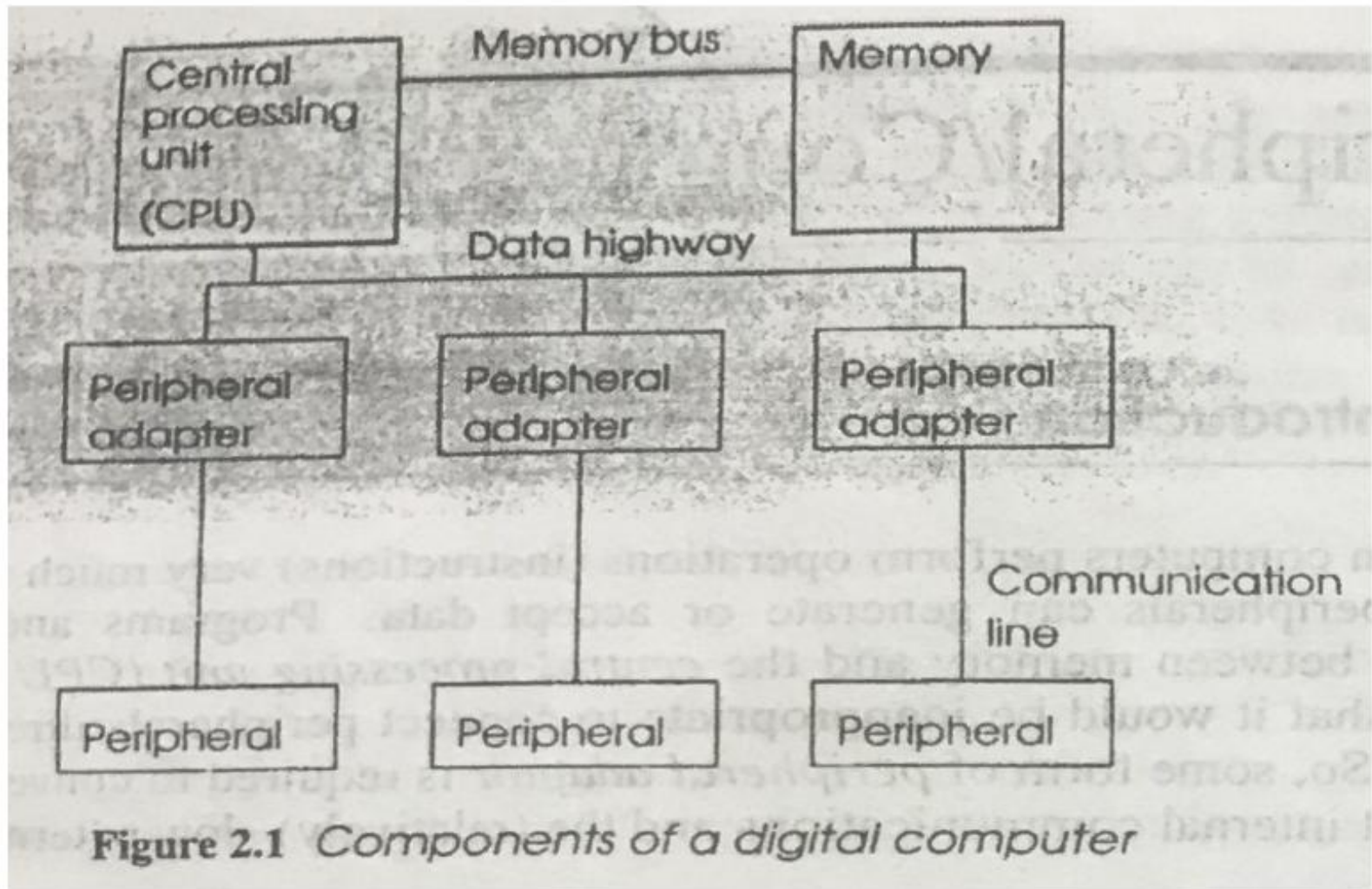
Data Highway

- Data (including programs) are moved around the computer on a set of wires forming a data highway (Bus).
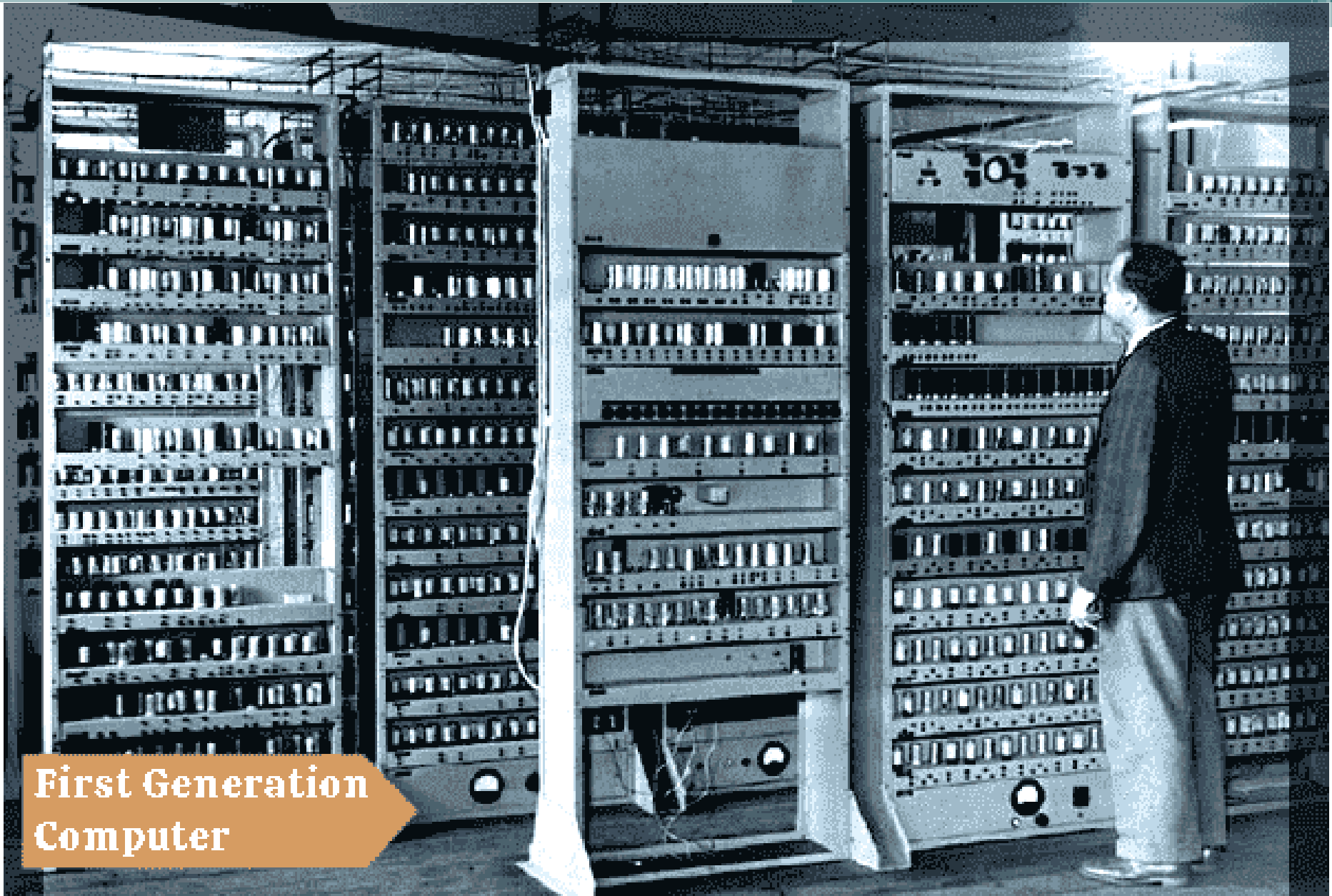
- Address Bus, Control Bus, Data Bus

Computer Generations

Following are the main five generations of computers.

Sr. No.	Generation & Description
1	**First Generation** The period of first generation: 1946-1959. Vacuum tube based.
2	**Second Generation** The period of second generation: 1959-1965. Transistor based.
3	**Third Generation** The period of third generation: 1965-1971. Integrated Circuit based.
4	**Fourth Generation** The period of fourth generation: 1971-1980. VLSI microprocessor based.
5	**Fifth Generation** The period of fifth generation: 1980-onwards. ULSI microprocessor based.

First Generation

- The first computers used vacuum tubes for circuitry
- magnetic drums for memory, and were often enormous, taking up entire rooms.
- Expensive and generate huge heat
- Relied on machine language to perform operations.
- Could only solve one problem at a time
- Input was based on punched cards and paper tape, and output was displayed on printouts.
- The UNIVAC and ENIAC computers are examples of first-generation computing devices.

First Generation Computer

Second Generation

- Transistors replaced vacuum tubes
- Transistors were used that were cheaper, consumed less power, more compact in size, more reliable and faster.
- Magnetic cores were used as the primary memory and magnetic tape and magnetic disks as secondary storage devices.
- Assembly language and high-level programming languages like FORTRAN, COBOL were used.
- Used batch processing and multiprogramming operating system.

Third Generation

- emerged due to the development of the integrated circuit (IC).
- More reliable in comparison to previous two generations
- Smaller size, Generated less heat, Faster
- Lesser maintenance
- Consumed lesser electricity
- Supported high-level language
- Example: IBM-360 series

Fourth Generation

- Used Very Large Scale Integrated (VLSI) circuits.
- VLSI circuits having about 5000 transistors and other circuit elements with their associated circuits on a single chip
- More powerful, compact, reliable, and affordable
- All the high-level languages like C, C++, DBASE etc., were used in this generation.

Fifth Generation

- An initiative by Japan's Ministry of International Trade and Industry (MITI), begun in 1982, to create computers using massively parallel computing and logic programming.
- ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components.
- All high level language are used.
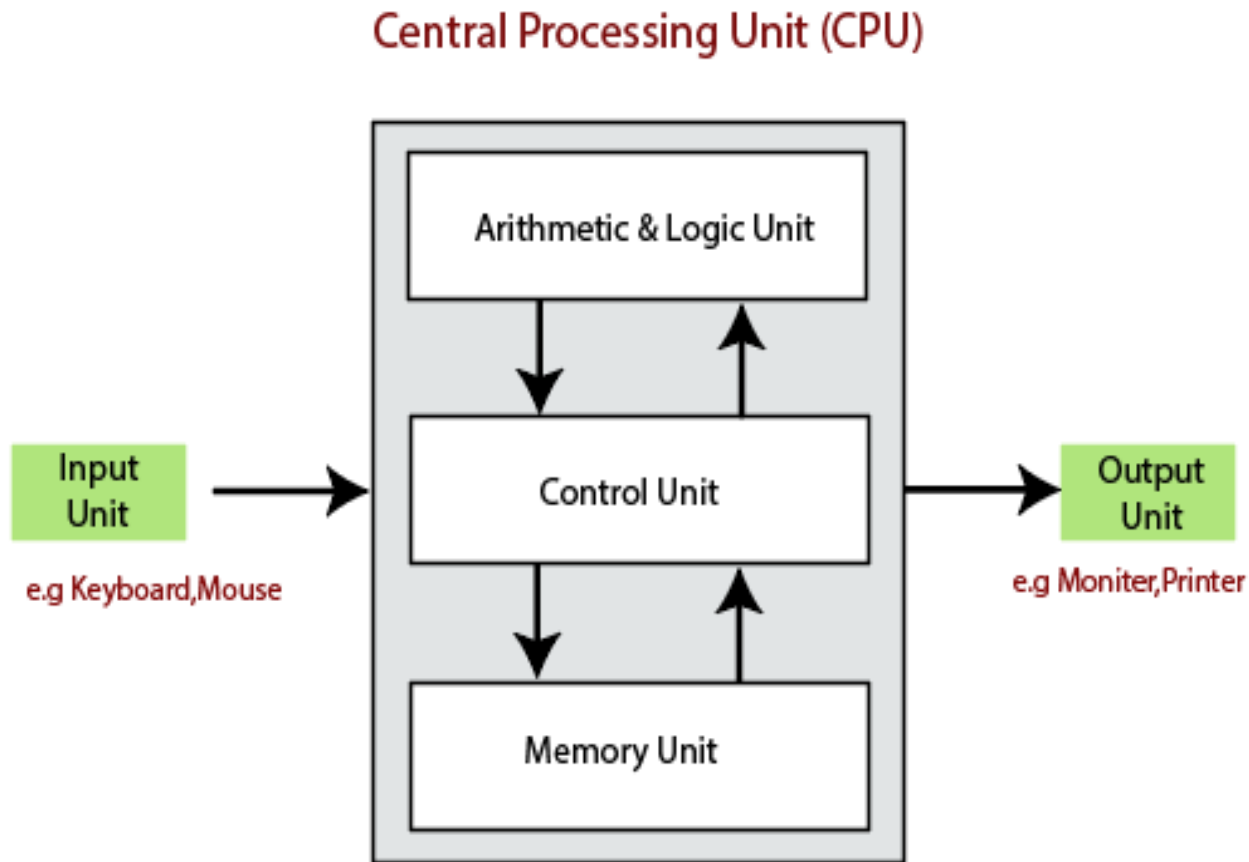- Use of Natural language processing, Parallel Processing, true artificial intelligence.

Computer Workflow

Simplest Workflow of Computer

- Input- Data
- Output- Information
- Raw facts and figures which can be processed using arithmetic and logical operations to obtain information are called data.
- Processes that can be applied to data are of two types:
    - ✓Arithmetic Operation
    - ✓Logical Operation

Block Diagram of Computer

Central Processing Unit (CPU)

Input Unit
e.g Keyboard,Mouse

Arithmetic & Logic Unit

Control Unit

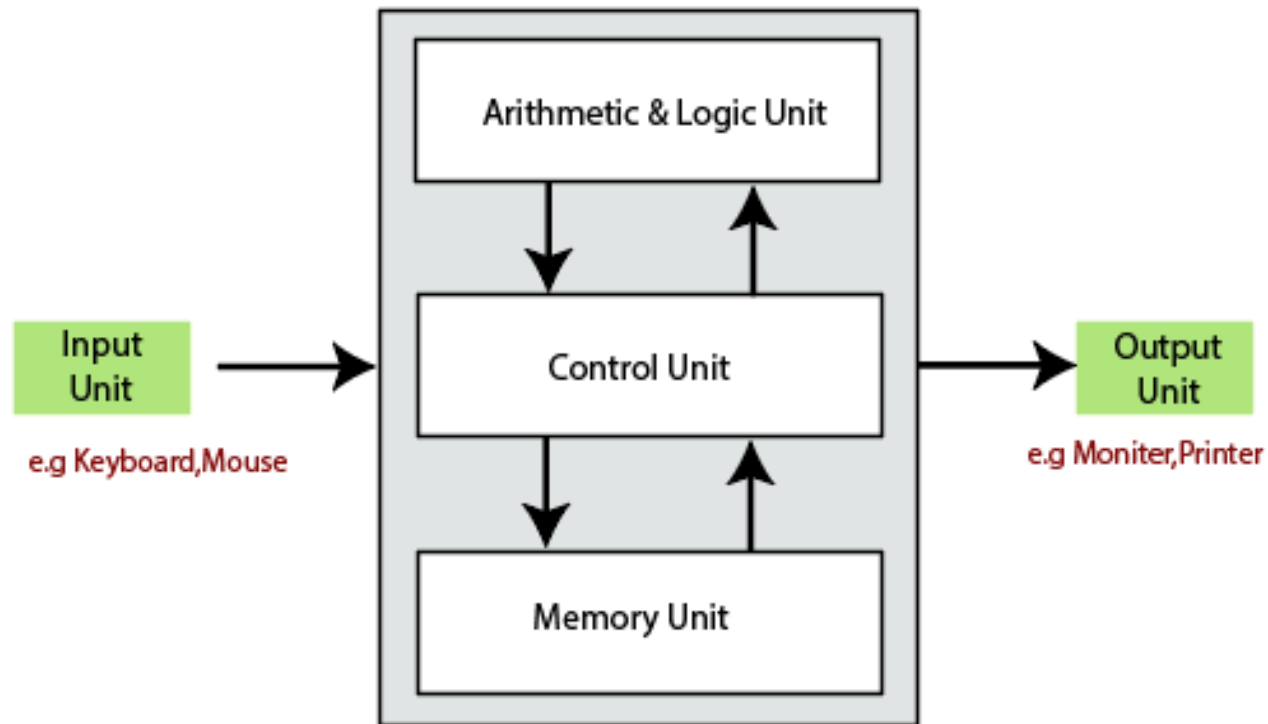Memory Unit

Output Unit
e.g Moniter,Printer

Input Unit

- Input unit consists of input devices such as mouse, keyboard etc.
- Convert the inputted data or instructions into binary form for further processing.
- Transmit the data to the main memory

Output Unit

- Output unit consists of devices that are used to display or output of processing.
- Output data is first stored in the memory and then displayed in human-readable form.
- Accepts the data or information in binary form from the main memory of the computer system.
- Converts the binary data into a human-readable form

Central Processing Unit

Central Processing Unit (CPU)

Arithmetic & Logic Unit

Control Unit

Input Unit

e.g Keyboard,Mouse

Output Unit

e.g Moniter,Printer

Memory Unit

Control Unit

- Controls all the activities and operations of the computer
- Determines the sequence in which computer programs and instructions are executed.
- It retrieves instructions from memory, decodes the instructions, interprets the instructions and understands the sequence of tasks to be performed accordingly.

Arithmetic and Logic Unit

- Performs arithmetic and logical operations.
- arithmetic unit controls-addition, subtraction, division, and multiplication
- logical unit controls- AND, OR, Equal, greater than, and less than, comparing, selecting, matching and merging data.
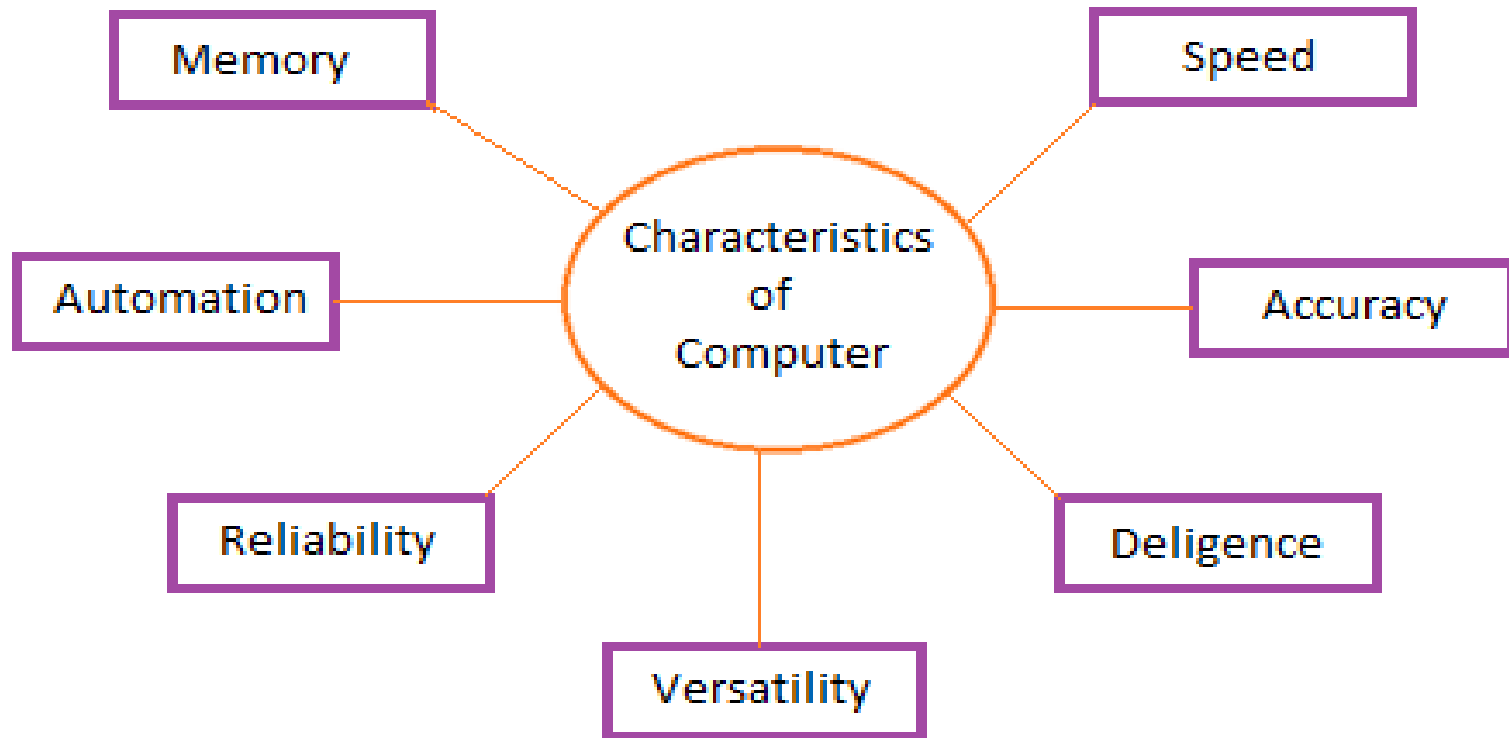
Memory Unit

- Used to store data and instructions before and after processing.
- Primary and Secondary Memory

Hardware vs. Software

- Hardware
  - The computer equipment
  - Includes printers, monitors, disk drives, etc.
- Software
  - Programs which tell the computer what to do
  - Examples - word processing, gradebook, tutorials, games, etc

Features of Computer

- **Speed:** Computers can process millions (1,000,000) of instructions per second. The time taken by computers for their operations is microseconds and nanoseconds.

- **Accuracy:** Computers perform calculations with 100% accuracy. Errors may occur due to data inconsistency or inaccuracy.

- **Diligence:** A computer can perform millions of tasks or calculations with the same consistency and accuracy. It doesn't feel any fatigue or lack of concentration.

- **Versatility:** Versatility refers to the capability of a computer to perform different kinds of works with same accuracy and efficiency.

- **Reliability:** A computer is reliable as it gives consistent result for similar set of data.

- **Automation:** Computer performs all the tasks automatically i.e. it performs tasks without manual intervention.

- **Memory:** A computer has built-in memory called primary memory where it stores data.
Secondary storage are removable devices such as CDs, pen drives, etc., which are also used to store data.

Disadvantages of Computers

No I.Q: A computer is a machine that has no intelligence to perform any task. Each instruction has to be given to the computer. A computer cannot take any decision on its own.

Dependency : It functions as per the user's instruction, thus it is fully dependent on humans.

Environment : The operating environment of the computer should be dust free and suitable.

No Feeling : Computers have no feelings or emotions. It cannot make judgment based on feeling, taste, experience, and knowledge unlike humans.

Booting

- Starting a computer or computer embedded device is called booting.
- To boot (to start up or booting) a computer is to load an operating system into the computer's main memory or <u>RAM</u>.

Booting Steps

- ✓ Switching on power supply.
- ✓ Loading operating system into computer's main memory.
- ✓ Keeping all applications in a state of readiness in case needed by user.

- The first program or set of instructions that run when the computer is switched on is called BIOS or Basic Input Output System.

Rebooting

- Restarting a system when it is already running.
- Rebooting may be required if,
  - A software or hardware has been installed.
  - System is unusually slow.

2 types of booting:
- **Cold booting**: System is started by switching on power supply. The next step of is loading of BIOS.
- **Warm booting**: When the system is already running and needs to be restarted.

Warm booting is faster than cold booting

Classification of Computer

- The computer systems can be classified on the following basis:

  1. On the basis of size.
  2. On the basis of functionality.
  3. On the basis of data handling.

On the Basis of Size

- Super computer
- Mainframe computer
- Mini computer
- Micro computer

Super Computer

- Fastest and most powerful type of computer
- Very Expensive
- Used in specialized applications that require immense amounts of mathematical calculations.
- Example: PARAM, jaguar, roadrunner
- Used Example: animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration.
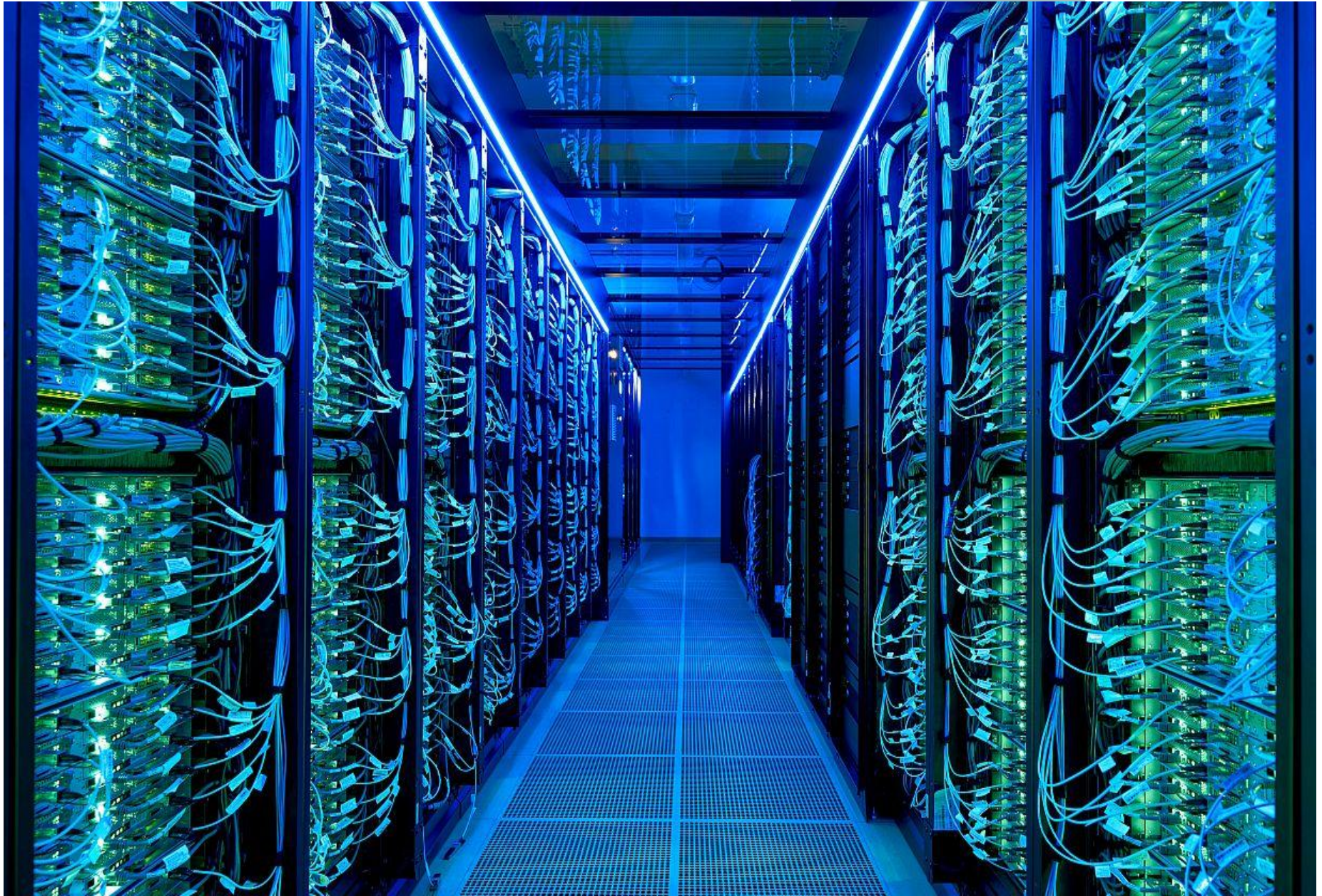
Mainframe Computer

- A very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously.
- support more simultaneous programs than super computer.
- Example: IBM z Series, System z9 and System z10 servers.

Mini Computer

- In size and power, minicomputers lie between *workstations* and *mainframes.*
- multiprocessing system capable of supporting from 4 to about 200 users simultaneously.

Micro Computer

- **Desktop Computer**: a personal or micro-mini computer sufficient to fit on a desk.
- **Laptop Computer**: a portable computer complete with an integrated screen and keyboard. It is generally smaller in size than a desktop computer and larger than a notebook computer.
- **Palmtop Computer/Digital Diary /Notebook /PDAs**: a hand-sized computer. Palmtops have no keyboard but the screen serves both as an input and output device.
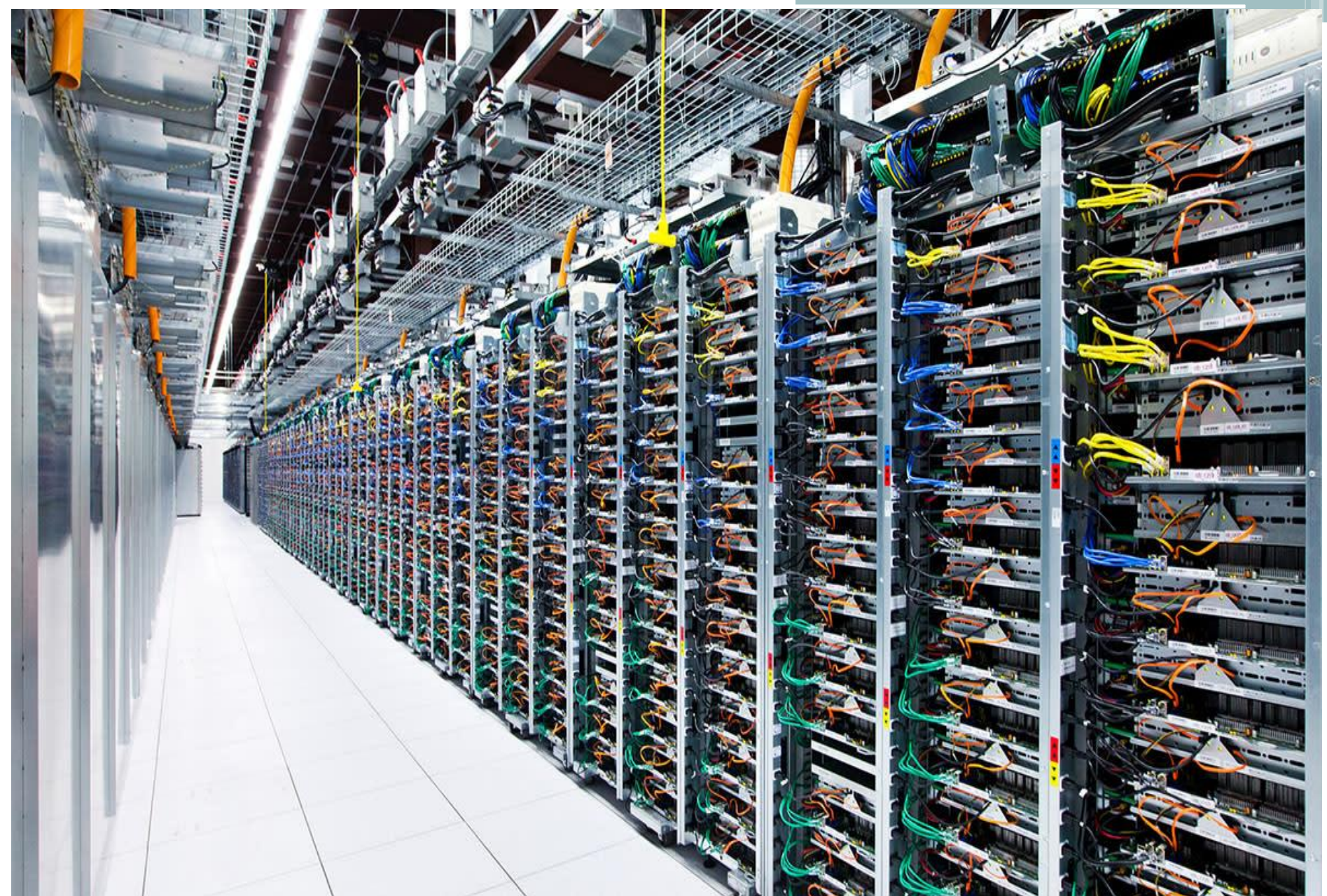
Microcomputer types

On the basis of functionality.

- **Servers**
- **Workstation**
- **Information Appliances**
- **Embedded computers**

Servers

- Servers are nothing but dedicated computers which are set-up to offer some services to the clients.
- Example: Security server, database server etc.

Workstation

- Designed to primarily to be used by single user at a time.
- Run multi-user operating systems

Information Appliances

- Portable devices which are designed to perform a limited set of tasks like basic calculations, playing multimedia, browsing internet etc.
- Generally referred as the mobile devices.
- Have very limited memory and flexibility and generally run on "as-is" basis
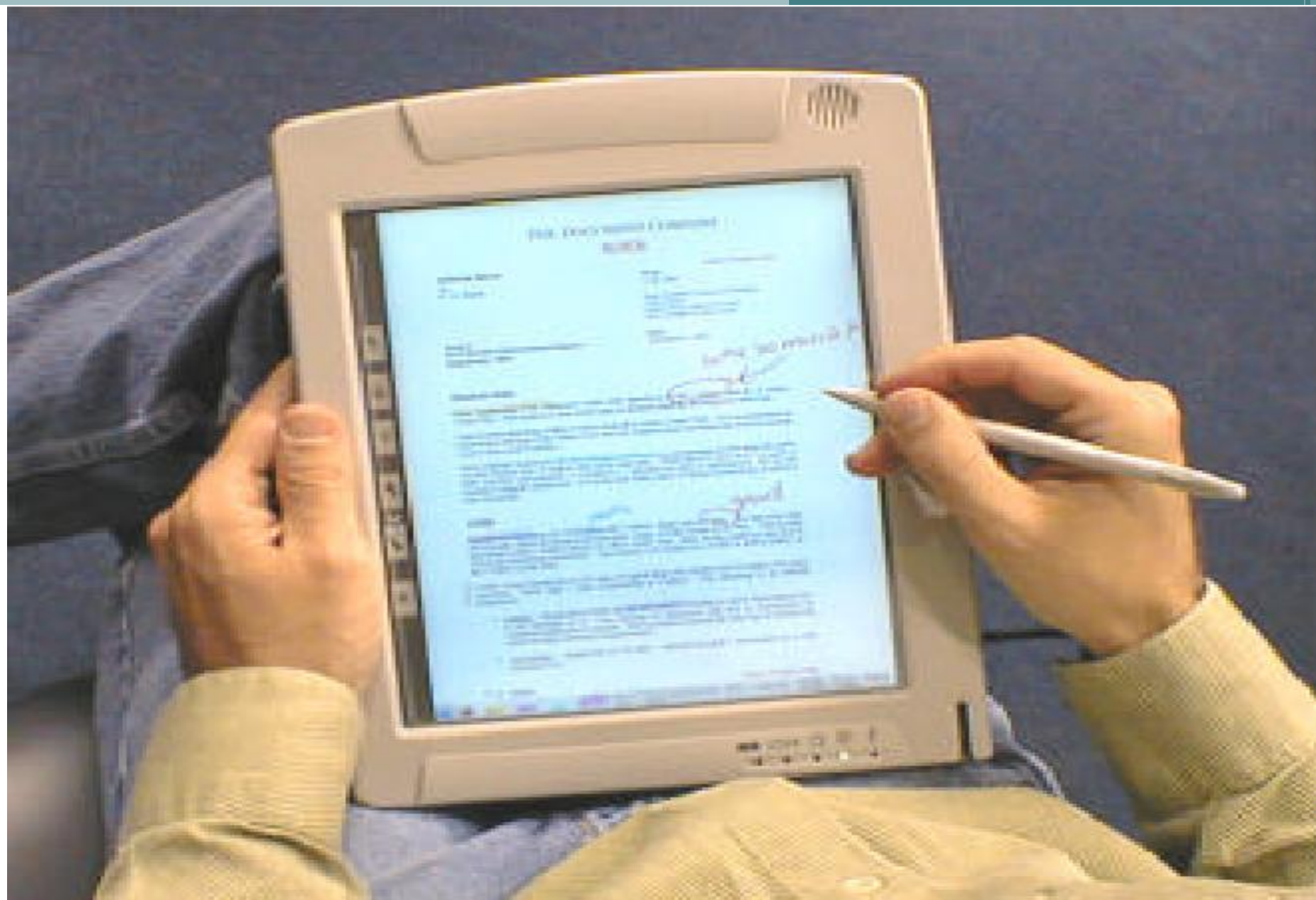
Embedded Computer

- Computing devices which are used in other machines to serve limited set of requirements.
- Follow instructions from the non-volatile memory.
- Not required to execute reboot or reset.
- Processing units different from personal computers.

On the basis of data handling

- Analog
- Digital
- Hybrid

Analog

- An analog computer is a form of computer that uses the continuously-changeable aspects of physical fact such as electrical, mechanical to model the problem being solved.
- Any thing that is variable with respect to time and continuous can be claimed as analog.

Digital

- A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system of "0" and "1", Computer capable of solving problems by processing information expressed in discrete form.

Hybrid

- A computer that processes both analog and digital data, Hybrid computer is a digital computer that accepts analog signals, converts them to digital and processes them in digital form.

Thank You