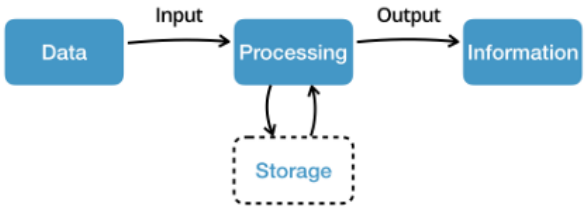
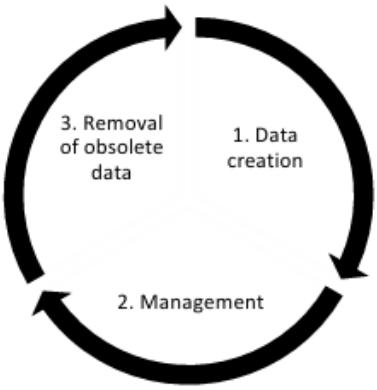
UNIT 01 SHORTNOTE

Data vs Information

Data	Information
Raw, unprocessed facts and figures	Processed, organized, and meaningful data
Unstructured and meaningless on its own	Structured and meaningful
Collected for processing	Used for decision-making
Numbers, symbols, letters	Reports, summaries, insights
Input for systems	Output from systems
May contain errors or inconsistencies	Accurate and verified



Lifecycle of Data



Data: 2 types

i. **Qualitative** – non-numerical characters
Eg – Color of a ball, taste of a fruit etc..

ii. **Quantitative** – numerical
Eg – Marks obtained in a test

Characteristics of valuable information

- Relevance
- Timeliness
- Accuracy
- Completeness
- Understandability

Golden Rule of information - Value of information in its maximum level at the moment the information is created or the information is released. The value of the information is reduced gradually with the time and become less valuable.

Big Data – 3 main properties (Volume, velocity, variety)

Drawbacks of manual methods in manipulating data and information

- Inconsistency and duplication in data
- Room for errors
- Delay in processing
- Lack of sharing information
- Reduced customer services

The Internet

- The Internet is a network of networks where users can access information from other connected computers.
- Developed from ARPANET by the U.S. Department of Defense in 1969.
- Initially used by computer professionals, engineers, and scientists. Now a public, cooperative, and self-sustaining facility used by millions globally.
- Utilizes a portion of public telecommunication networks.

World Wide Web (WWW)

- Was created in 1991 by Tim Berners-Lee.
- HTTP (Hypertext Transfer Protocol): A set of rules for exchanging files like text, images, sound, video, and other multimedia. This Enables communication between web browsers and servers.
- Web Browser is a Software required to view web pages

Mobile communication refers to the wireless transmission of information without using cables or electrical conductors. Initially limited to one pair of users on a single channel, modern mobile communication uses techniques like TDMA, CDMA, and FDMA to accommodate multiple users. **Mobile computing** enables the transmission of data, voice, and video through wireless-enabled devices, allowing users to stay connected without relying on fixed physical links. (Mobile computing = Mobile Hardware + Mobile Software + Mobile Communication)

Cloud Computing

Refers to a Network or Internet. A Cloud is present at a remote location and provides services over a network.

3 Categories →

1**. Infrastructure as a Service (IaaS)** - provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc.
Ex - Customer Relationship Management, games, virtual desktop applications

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2. **Platform as a Service (PaaS)** - provides the runtime environment for applications, development & deployment tools, etc. Ex - Database, web server, deployment tools

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3. **Software as a Service (SaaS)** - allows to use software applications as a service to end users. Ex – Virtual machines, servers, storage, networks

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A system can be defined as an interrelated components work together to achieve a common objective.

In an information system data input into the system is Processed using processing instructions given and information is produced as output. **This is called an abstract model of information.**

Computer System consists of four major components
• Hardware • Software • Firmware • Live ware

Output Devices
• **Monitor (Visual display Unit)** -> Forms image using pixels, Resolution of images depend on (ppi)
i. Cathode-Ray Tube (CRT)
ii. Flat-Panel Display.
a. Liquid Crystal Display (LCD)
b. Light Emitting Diode (LED)

• **Printer** -> Produces hard copies
i. Impact printers - Dot Matrix Printer, Line printer, Daisywheel
ii. Non-Impact printers - Laser printers and Inkjet printers, plotters

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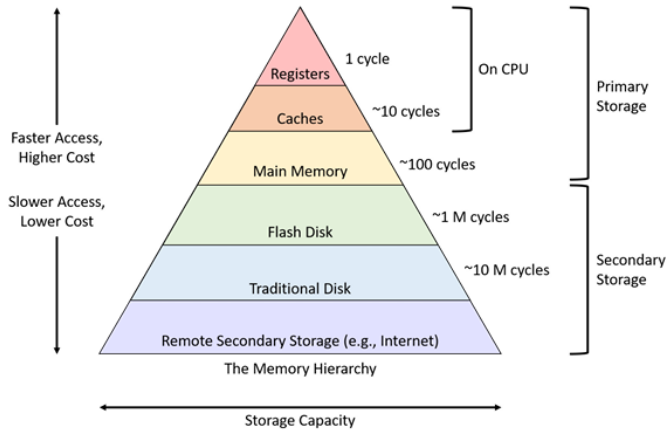
Motherboard (It is a circuit board located inside a computer system which every hardware components are connected to each other)

Memory Devices - used to store data and instructions,
• **Cache Memory** -> a very high-speed semiconductor memory which can speed up the CPU, acts as a buffer between the CPU and the main memory, It is known as CPU memory, volatile.

• **Primary Memory/Main Memory** -> Holds only those data and instructions on which the computer is currently working, has a limited capacity. Volatile. Generally made up of semiconductor device.

• **Secondary Memory/ External Memory/ Auxiliary Memory** -> non-volatile, slower than the main memory. Used for storing data and information permanently. CPU does not access these memories directly. Eg: Hard Disk, DVD, Flash drive, Memory Cards



Computer Software
1**. System Software** - Designed to operate and control the computer hardware and It provides a platform for running application software.
i. **Operating Systems** – Windows, Linux, Mac OS
ii. **Utility Software** – Virus Guard, Device drivers
iii. **Language Translators** – Compiler, Interpreter

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2. **Application Software -** designed to satisfy a particular need of a particular environment.
E.g. - MS Office, Paint
i. **Open-Source Software** - Source code is available. Free to use, modify or redistribute.
ii. **Proprietary Software** - Source code is not available. Should have the permission from the owner of the software to use it.

Firmware - A computer program that is “Embedded" in s hardware device. It is called a Embedded software. In computers, firmware embedded in ROM and which handles booting up process of computers.

The steps in data processing
Data gathering → Data validation → Data input → Data Processing → Data output → Data storage

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Models of data input
1. Direct and Remote. 2. Online and Offline.

Data Processing

1. Batch processing - easy to handle huge amount of data. E.g. - (Billing systems, pay roll systems etc..)

2. Real time processing - Input, Processing and output as well as data storing occur simultaneously.
E.g. - monitoring systems, booking systems

Applications of ICT

1) Education → CBE (Computer Based Education), Simulations, Distance Learning and E-Learning, Individualized Learning.

2) Healthcare → ECG, EEG, CT scans, Diagnostic Systems, Patient Monitoring System, Pharmacy Information System

3) Agriculture → used to control conditions inside the green houses, Robotic machines, Automatic weed removers, insect control devices, Monitoring devices

4) Business and finance → payroll calculations, budgeting, sales analysis, financial forecasting, online accounting facility, ATM machines.

5) Engineering → CAD, CAM, CIM, 3D virtualization.

6) Tourism → Online planning and booking systems.

7) Media and journalism

8) Law enforcement → CCTV systems, GPS.

The impact of ICT in the society

• **Social and economic benefits of ICT →** impact in entertainment and leisure industry(online games and chat with friends etc..), increases in productivity, GDP and trade. access to information.

• **Social, economic, environmental, ethical, legal and Privacy issues caused by ICT →** job losses, time wastage, health issues, Digital divide(refers to the gap between individuals, communities, or countries with access to modern digital technology and those without.), e-waste. Property and right violations.

Green computing is the practice of using computing resources efficiently and eco-friendlily, aiming to reduce e-waste and promote recycling of electronic components, with many developed countries implementing regulations to minimize environmental impact.

Key Concepts in Information Security & Ethics

a) Confidentiality of Data/Information - Ensured using password protection, encryption techniques, and digital signatures.

b) Stealing/Phishing - A method used to steal sensitive information by pretending to be a trusted entity. Protection includes firewalls, passwords, updates, and avoiding suspicious emails/links.

c) Piracy - Illegal copying, distribution, or use of software.

d) Copyright/Intellectual Property Laws - Protects original works such as inventions, books, and creative content under intellectual property rights.

e) Plagiarism - Plagiarism is stealing and presenting someone else's work as your own without giving credit.

A **software license** governs the use, modification, and distribution of software. Proprietary software keeps the source code hidden, while **FOSS** allows users to view, modify, and share the code.

Unlicensed software includes public domain or internal software used within organizations. Using unlicensed software outside legal terms can lead to copyright issues.

UNIT 02 SHORTNOTE

► *Computer Evolution*

× **Pre-Mechanical Era (before 1450) – Abacus**; the first calculating device. used by Chinese around 5000 BC.

× **Mechanical era (1450-1840)**

- **Pascaline** - by Blaise Pascal in 1642. It could add and subtract two numbers.
- **Stepped Reckoner** - by Gottfried Wilhelm Leibniz in 1694. Carried out operations add, subtract, multiply and division.
- **Difference engine** - first mechanical computer – developed by Charles Babbage in 1822.
  He is considered as the "**Father of the computer**".
  Madam **Ada Augusta Lovelace** is considered as the first programmer since she wrote write programmes for the Analytical Engine(Also developed by Charles Babbage).

× **Electro mechanical era (1840 – 1940)**

- **Tabulating machines –** by Herman Hollerith(1890)
- **Mark 1 -** the first automatic computer invented by Professor Howard Aiken in 1939.

× **Electronic Era**

1st Generation Computers (1940-1956) –
vacuum tubes as the basic component.

- **ENIAC** (Electronic Numerical Integrator and Calculator) the first electronic digital computer designed by John Mauchly and J. Presper Eckert in 1946.
- **EDVAC** (Electronic Discrete Variable Automatic Computer) is considered as the first digital computer that could store program was built in 1948.
- **EDSAC** (Electronic Delay Storage Automatic Calculator) was the first full size stored program computer developed by Maurice Wilkes in 1949.
- **UNIVAC** (Universal Automatic Computer) by Remington Rand.

Relied on machine language, Can solve only 1 problem At a time, Inputs were based on punched cards and paper Tapes, output on papers, expensive & often caused Malfunctioning, expensive, high electricity consumption And heat wastage.

2nd Generation Computers (1956 – 1963)
transistors were used as the fundamental building block. IBM 1620, IBM 7094, CDC 1604, CDC 3600, UNIVAC 1108 were some computers developed in this generation.

Relied on magnetic core memory, magnetic tapes.
Punched cards for input and print papers for output.
Assembly language was introduced

3rd Generation Computers (1964 – 1975)
Used Integrated Circuits (ICs)
IBM-360 series, PDP (Personal Data Processor), TDC-316 were the computers of 3rd generation.
Punched cards and printouts were replaced by keyboards and monitors, Ascii was introduced (in 1963)

4th Generation (1975 – 1989)
VLSI (Very Large Scale Integrated) circuits were used.
Introduction of microprocessors (e.g., Intel 8086, 80286).
Development of graphical user interfaces (GUIs).

IBM introduced the first PC (1981).
Apple introduced Macintosh (1984) with a GUI and mouse.
MS-DOS was widely used on IBM PCs.
Microsoft launched Windows 1.0 (1985).
LAN (Local Area Network) emerged.

5th Generation Computers (1989 – present)
The ULSI (Ultra Large Scale Integration) technology is used.
Focused of AI and Machine learning
Eg: Desktop, Laptop, Notebook, Ultrabook

► Classification of Computers

1. Based on the Technology - Analog Computer, Digital Computer
2. Based on the Purpose - Special purpose computer, General purpose computer
3. Based on Size - Super Computer (E.g. -TIANHE-1), Mainframe Computer, Mini Computer, Micro Computer(Desktop, Laptop, Notebook, Smart, Tablet)

► Input Devices

* Keyboard
* Pointing devices (Mouse, Touchpad, Remote control, touch screen)
* Direct entry (Magnetic strip reader, Bar code reader, smart card reader)
* Image and video(video camera, Digital camera, Webcam, CCTV)
* Scanning(Flatbed scanner, MICR, OMR, OCR, Graphic tablet, digitizer, Microphone)

Advantages of direct entry input device over key board entry input device - Automatically capture data, data entry cost is reduced, Accurate, more efficient.

► **Output devices**

Monitor

1. **CRT Monitor** (Cathode Ray Tube Monitor) - Images are produced when an electron beam strikes a phosphorescent surface
2. **LCD Monitor** (using Thin Film Transistor-TFT) Liquid Crystal Display (LCD) that has a transistor for each pixel. widely used in notebook and laptops.
3. **LED Monitor** (Light Emitting Diode Monitor) - Used as a computer monitor or television.

Advantages →Less expensive, More reliable, Generate low heat and consume less power, Longer lifespan and less environmental impact.

Printer - Used to produce a hard copy output.

1. **Dot matrix printer** - Uses a print head that moves on the page and prints by striking an ink ribbon against the paper.
2. **Inkjet printer** - The print head has several jets. As the paper moves past the print head, the nozzles spray ink onto it, forming the characters and images.
3. **Laser printer** - A laser beam draws the document on a selenium-coated drum using electrical charges. After the drum is charged, it is rolled in toner, a dry powder type of ink. The toner adheres to the charged image on the drum. The toner is then transferred onto a piece of paper and fused to the paper with heat and pressure.
4. **Graphic plotter** – interprets commands from a computer to make line drawings on paper with automated pens.

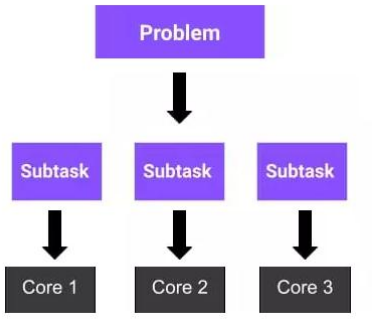
► **CPU and its compatibility with motherboard**

1. Socket support
2. Chipset support
3. Motherboard wattage support
4. BIOS support

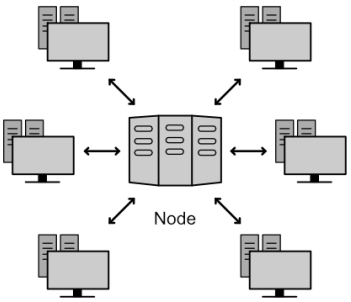
► **Storage Devices**

1. Fixed internal magnetic hard disk
2. External hard disk
3. Magnetic tape
4. Optical disc
5. Flash drive
6. Memory card

Parallel computing – A type of computing Architecture where multiple processors or cores work together simultaneously to solve a problem faster. It divides large tasks into smaller subtasks, which are processed in parallel.



► **Grid computing** – Where Multiple computers across different locations work together to solve large-scale problems by sharing resources such as processing power, storage, and data over a network.



► **Schedulers** - Schedulers are types of applications responsible for the management of jobs

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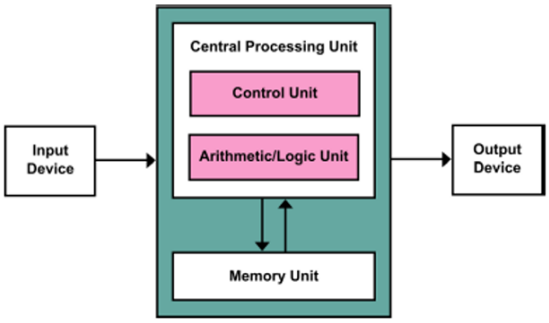
► **Von-Neumann Architecture**



Major components of this architecture:

1. Central processing unit

(i) Control unit (CU) : This unit controls signals of all devices of a computer system.

(ii) Arithmetic and logic unit (ALU) : It carries out mathematical and logical operations.

(iii) Memory register : A CPU register is one of a small set of data holding places which is part of the computer processor. A register may hold an instruction, a storage address, or any kind of data

2. Memory

(i) Primary memory

(ii) Secondary memory

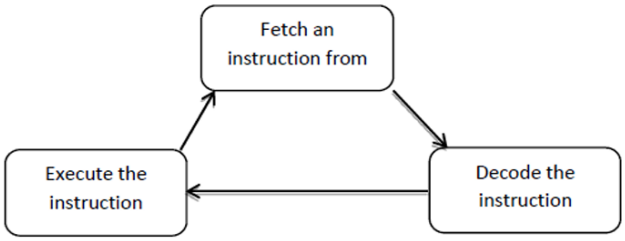
3. Input device

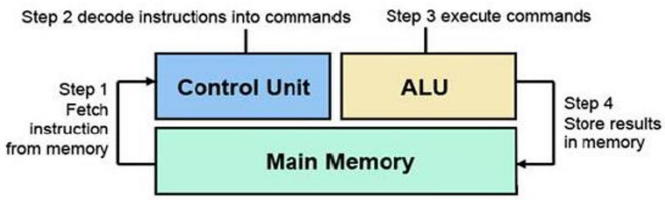
4. Output device

Data bus - A system within a computer or device, consisting of a connector or set of wires, that provides transportation for data.

Control bus - Used to transmit a variety of control signals to components and devices.

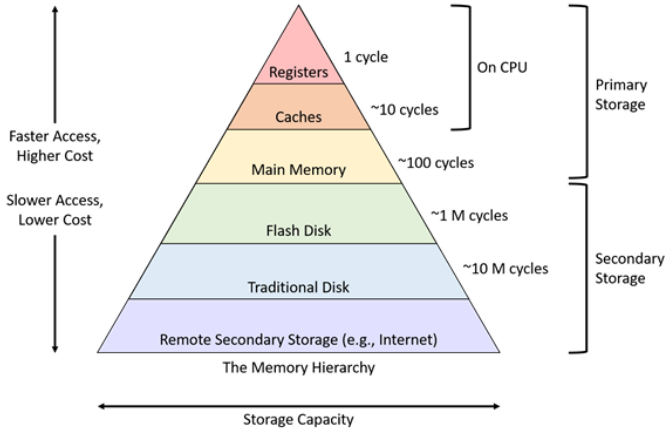
► **Fetch-execute-cycle**





► **Multi-core processor** is a single computing component with two or more independent actual processing units (cores), which are units that read and execute program instructions. Therefore, the single processor can run multiple instructions on separate cores at the same time.
Need of multi-core processor
1. Can be run a program by dividing some parts. So, it gets executed fast.
2. It enables parallel programming.
3. To get the high performance from a single machine.

Memory Hierarchy



► **Registers**
Allow the CPU to execute various tasks at very high speed.
2 types → General purpose & Special purpose registers
Memory Buffer register (MBR) stores the data being transferred from the memory for data processing and the data to be transferred to the memory.
Memory Address Register (MAR) contains the address of The memory of which we either want to read or write
Program Counter(PC) holds the address of the next instruction to be executed
The **Instruction Register** (IR) holds the fetched instruction, while the Control Unit (CU) decodes it. The Current **Instruction Register** (CIR) holds the instruction currently being executed.
Accumulator is a memory register to store intermediate values of arithmetic & logical processing

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► **Volatile memory** - only holds the data while the device is powered.
1. Cache memory - Used to store program instructions that are frequently accessed by software during operation.
i. ***Level 1 (L1) cache*** - Extremely fast but relatively small, and is usually embedded in the processor chip (CPU).
ii. ***Level 2 (L2) cache*** - often more capacity than L1. It may be located on the CPU or on a separate.
iii. **Level 3 (L3) cache** - works to improve the performance of L1 and L2. It can be significantly slower than L1 or L2, but is usually double the speed of RAM.

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2. RAM (Random Access Memory) - the main memory of The computer that holds data for running applications and required data for a computer.
i. DRAM (Dynamic RAM) - continuously refreshed or it will lose its contents.
ii. SRAM(Static RAM) – consists of a flip-flop which consists of 6 transistors to keep a bit. No need for constant refreshing. Lesser data density and relatively expensive than DRAM.
iii. SDRAM (Synchronous DRAM) It is a type of memory that synchronizes itself with the computer's system clock.
iv. DDR SDRAM(Double Data Rate SDRAM) doubles the number of read or write operations to two accesses per system clock cycle.

► **Non-Volatile memory -** This is a type of computer memory that has the capability to hold saved data even if the power is turned off.

1. ROM (Read Only Memory) - ROM stores essential programs such as the program that boots the computer.
Types of ROM
i. **PROM** (Programmable ROM) - data can be written only once. Once a program has been written onto a PROM, it remains there forever.
ii. **EPROM** (Erasable PROM) retains its contents until it is exposed to ultraviolet light. The ultraviolet light clears its contents, making it possible to reprogram the memory.
iii. **EEPROM** (Electrically Erasable PROM) It can be erased by exposing it to an electrical charge.

2. Secondary storage

i. **Magnetic storage device** - Manipulation of magnetic fields on a medium in order to record audio, video or other data. Mostly involves a tape medium that is moved by read and write heads.(Uses sequential access)
Eg: Hard disk, Floppy disk, Magnetic tape

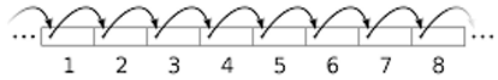
ii. **Optical storage device** - Data is written and read with a laser for archival or backup purposes. Typically, data is written to optical media, such as CDs and DVDs and Blu-Ray discs. Data is stored as pits and bumps in the disc surface, representing binary values

iii. **Solid state storage** - made from silicon microchips. It stores data electronically Solid - state storage can be found in three form factors: solid-state drives (SSD), solid-state cards (SSC) and solid-state modules (SSM). allows data transfer to and from storage media at a much higher speed and more durable.
Eg: Flash drive, Memory card

CMOS (Complementary Metal-Oxide-Semiconductor) memory is a small amount of volatile memory that stores BIOS (Basic Input/Output System) settings in a computer. It is backed by a battery, known as the CMOS battery, which ensures that the settings are retained even when the computer is powered off.

Memory Access methods

(i) Sequential access



(ii) Random access