Introduction to Information and Communication Technology

CS202 Lecture # 4

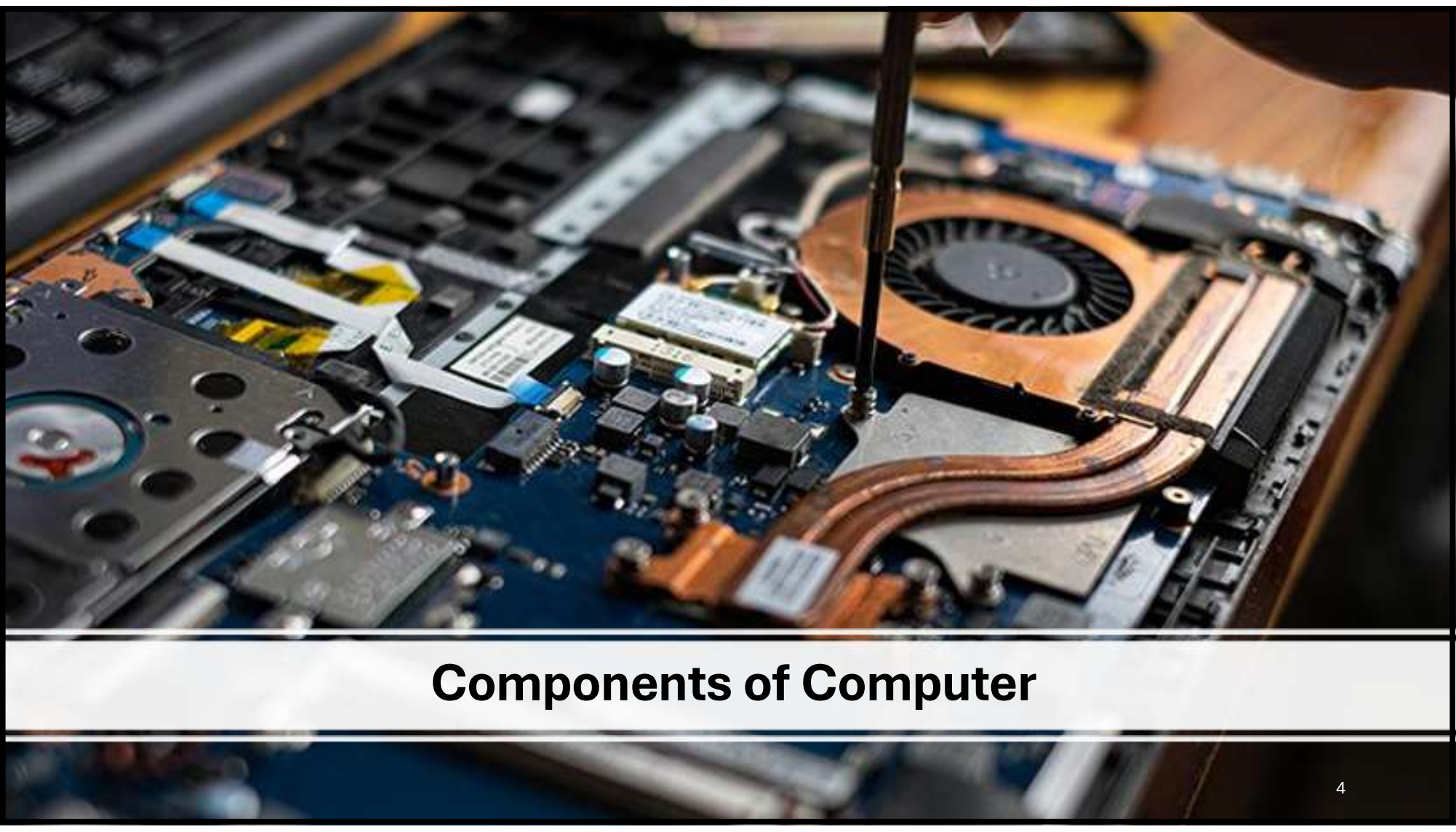
Prof. Dr. S. M. Hasan Zaidi

Topics Covered in Last Lecture

- Classification of Computers by Size
- Classification of Computers by Purpose
- Algorithms
- Data Structures
- Software Engineering
- Network Engineering

Today's Topics

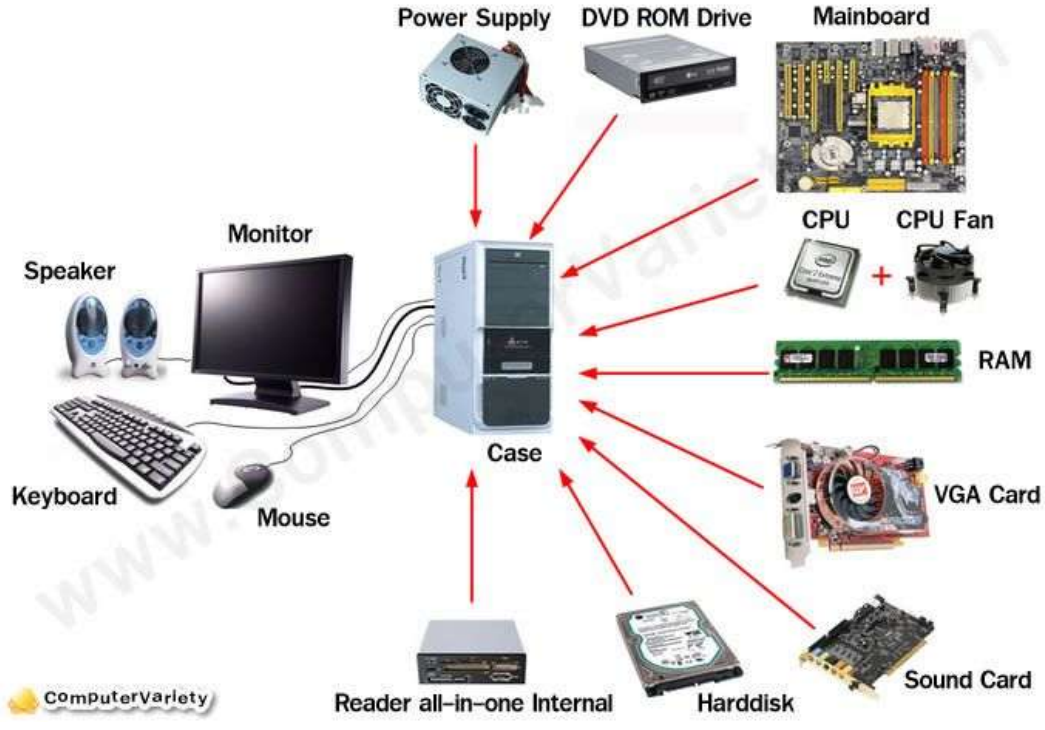
- Components of Computer
- The Fetch-Execute Cycle
- Analog and Digital Data
- Computer-Based Information Systems
- Some Future Areas of ICT



Components of Computer

Components of Computer

- **Hardware**
  1. CPU
  2. RAM & ROM
  3. Peripheral Devices
  4. Hard disk or SSD
  5. GPU
- **Software**
  6. System Software
  7. Application Software



Components of Computer

1. Central Processing Unit (CPU)

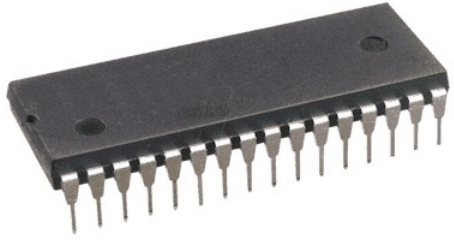
- “Brain" of Computer
- Executes instructions from programs, performs calculations, and manages data processing
- Composed of the control unit and the arithmetic logic unit (ALU)

Components of Computer

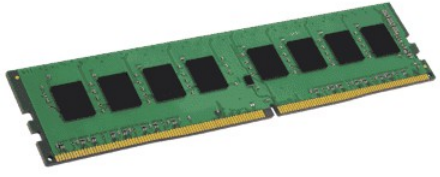
2. Random Access Memory (RAM) and Read Only Memory (ROM)

- **RAM:** Volatile and temporary storage that the CPU uses to store data and programs that are currently being used
- **ROM:** Non-Volatile and permanent small storage for BIOS and other start-up instructions

Feature	SRAM	DRAM
Storage element	Flip-flops (6 transistors)	Capacitor + 1 transistor
Speed	Faster	Slower
Cost	Expensive	Cheaper
Density	Lower (less memory per chip)	Higher (more memory per chip)
Refreshing	Not required	Required
Usage	CPU cache, registers	Main memory (system RAM)



STATIC RAM (SRAM)



Dynamic Ram (DRAM)

Components of Computer

3. Peripheral Devices

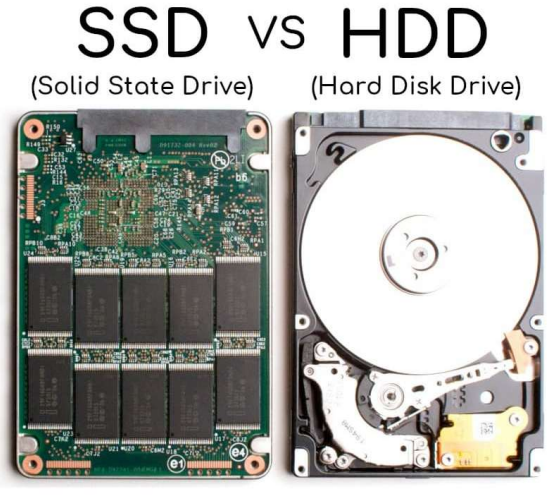
- External devices connected to the computer to extend its functionality
- **Input Peripherals:** Keyboards, mice, scanners, cameras
- **Output Peripherals:** Printers, monitors, speakers
- **Storage Peripherals:** External hard drives, USB flash drives

Components of Computer

4. Hard-Disk Drive (HDD) or Solid-State Drive (SSD)

- Permanent storage for large amounts of data
- Stores applications, operating systems and files
- They can be fixed or removable

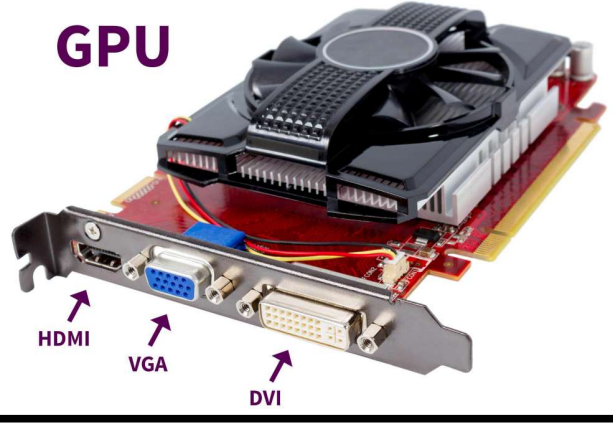
Feature	HDD	SSD
Storage medium	Magnetic platters	Flash memory chips
Moving parts	Yes	No
Speed	Slower	Much faster
Cost per GB	Cheaper	More expensive
Durability	Susceptible to shock/damage	More durable
Capacity	Higher (up to several TBs)	Moderate to high (increasing)



Components of Computer

4. Graphics Processing Unit (GPU)

- Specialized electronic circuit originally designed for digital image processing and to accelerate computer graphics
- A discrete video card or embedded on motherboards, mobile phones, personal computers, workstations, and game consoles



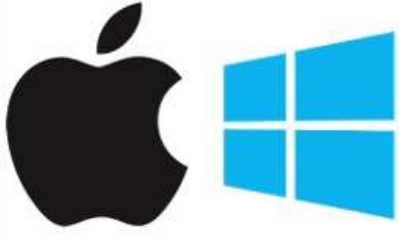
Advanced GPU Lab at GIKI

Make and Model	Specifications		No. of Workstations	Date of Procurement (Month/Year)
Thunder Tizona RTB ATX Case	**Processor**	14th Gen Intel® Core® i9 x32	16	June 2024
	RAM	64GB DDR4- 4200 - MHz		
	Storage	1TB NVME SSD and 3TB HDD		
	Ethernet/Wi-Fi	Wi-Fi/Ethernet Both		
	Graphic Card	NVIDIA RTX 4090 Ti 24GB		
	Display	27" Inch WQHD (2560 x 1440) MSI Monitor		

Components of Computer

5. System Software (Operating System)

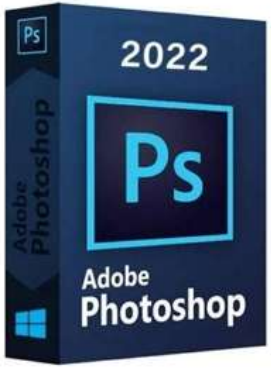
- Software that runs in the background and manages basic functions of the computer
- **Examples:** Windows, macOS, Linux

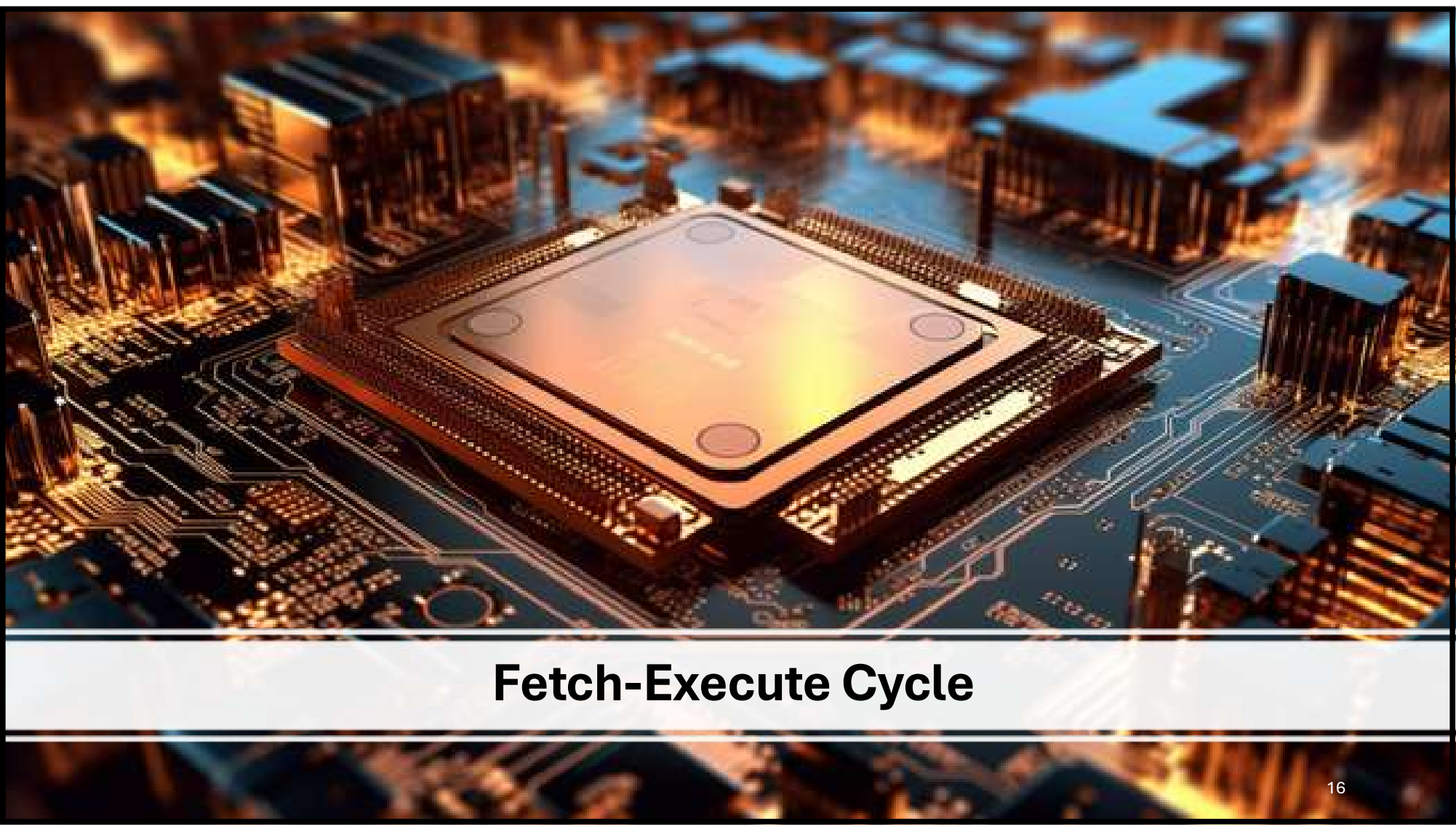


Components of Computer

6. Application Software

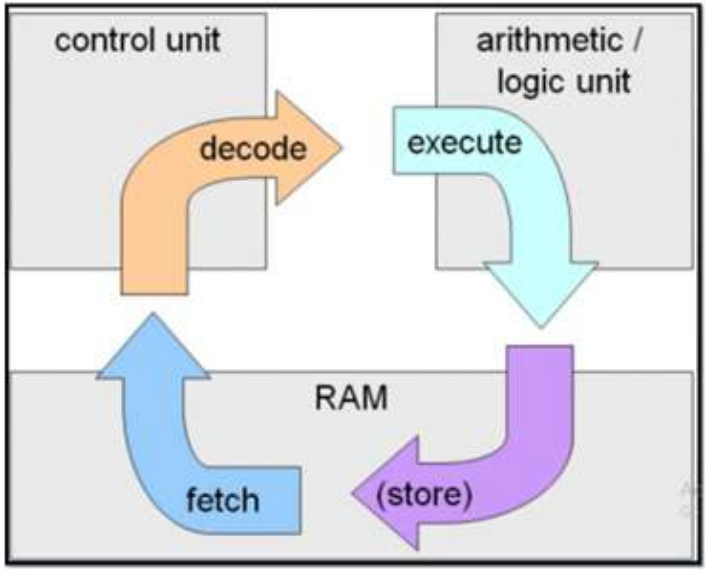
- Programs designed to perform specific tasks for the user
- **Examples:** Microsoft Office, Google Chrome, Adobe, AutoCAD etc





Fetch-Execute Cycle

The Fetch-Execute Cycle



The fetch-execute cycle is the basic process that a Central Processing Unit (CPU) follows to execute instructions.

- **Fetch:** The Control Unit (CU) gets instructions from the Random Access Memory (RAM)
- **Decode:** The CU interprets / examines the nature of instructions to determine what operation needs to be performed
- **Execute:** The Arithmetic / Logic Unit (ALU) executes the operation specified by the decoded instruction
- **Store/Update:** The instruction is restored / updated in the RAM, if required

These four operations are collectively called “Machine Cycle”.

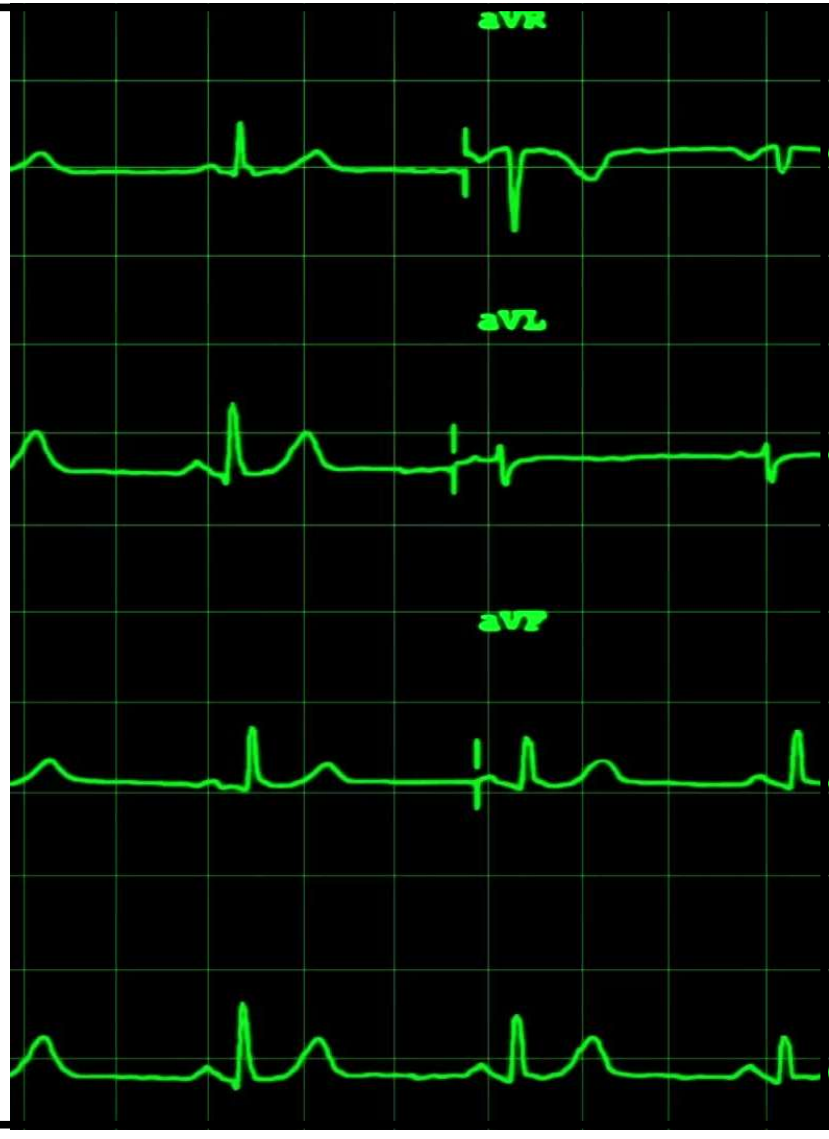
The cycle then repeats for the next instruction. This continuous process allows the CPU to execute programs efficiently.

Analog and Digital Data

Analog and Digital Data

Analog Data

- **Definition:** Continuous data that represents physical quantities in a wave-like or continuous form
- **Nature:** Infinite set of values; can vary smoothly over time
- **Examples:** Sound waves, light intensity, temperature, radio signals
- **Transmission:** Sent as continuous signals, like electrical voltage changes over time
- **Accuracy:** More prone to noise and degradation over long distances; harder to maintain precision
- **Devices:** Analog clocks, vinyl records, old telephones, and analog thermometers



Analog and Digital Data

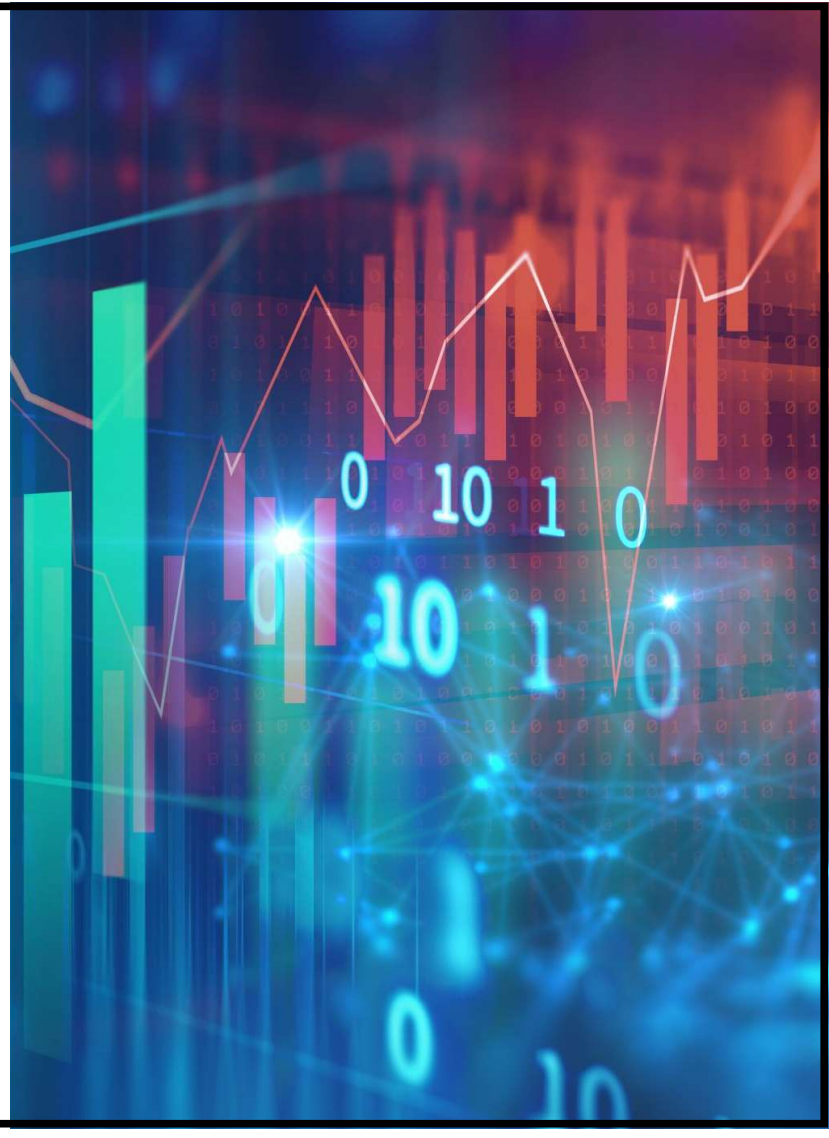
Digital Data

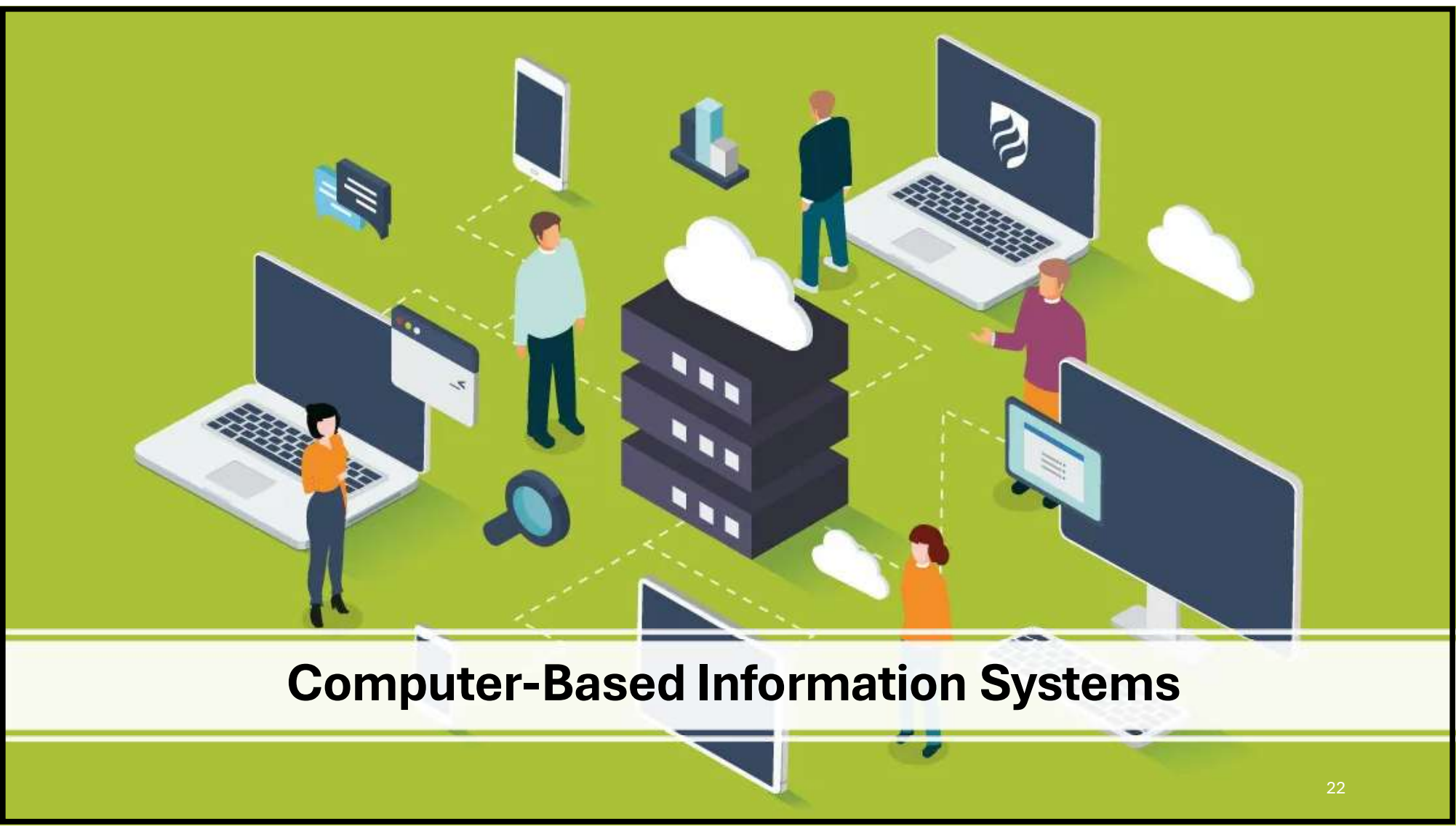
- **Definition:** Discrete data represented by binary (0s and 1s) in a form that computers can process
- **Nature:** Finite set of values; data is quantized into separate steps or bits
- **Examples:** Computer files, digital audio (MP3), digital video, text files
- **Transmission:** Sent as a series of discrete signals (on/off states) via binary encoding
- **Accuracy:** Less susceptible to noise; can be stored and transmitted with high precision and easily replicated without degradation
- **Devices:** Computers, smartphones, CDs, DVDs, and digital clocks

Analog and Digital Data

Key Differences:

- **Continuity:** Analog is continuous, while digital is discrete
- **Accuracy and Precision:** Digital data can be replicated and processed without loss, while analog data degrades more easily
- **Representation:** Analog data is often represented as waves, while digital data is represented as binary codes





Computer-Based Information Systems

Computer-Based Information Systems (CBIS)

A System that uses **computer technology** to **collect, process, store, and distribute information** for decision-making, coordination, control, analysis, and visualization in an **organization**

Computer-Based Information Systems

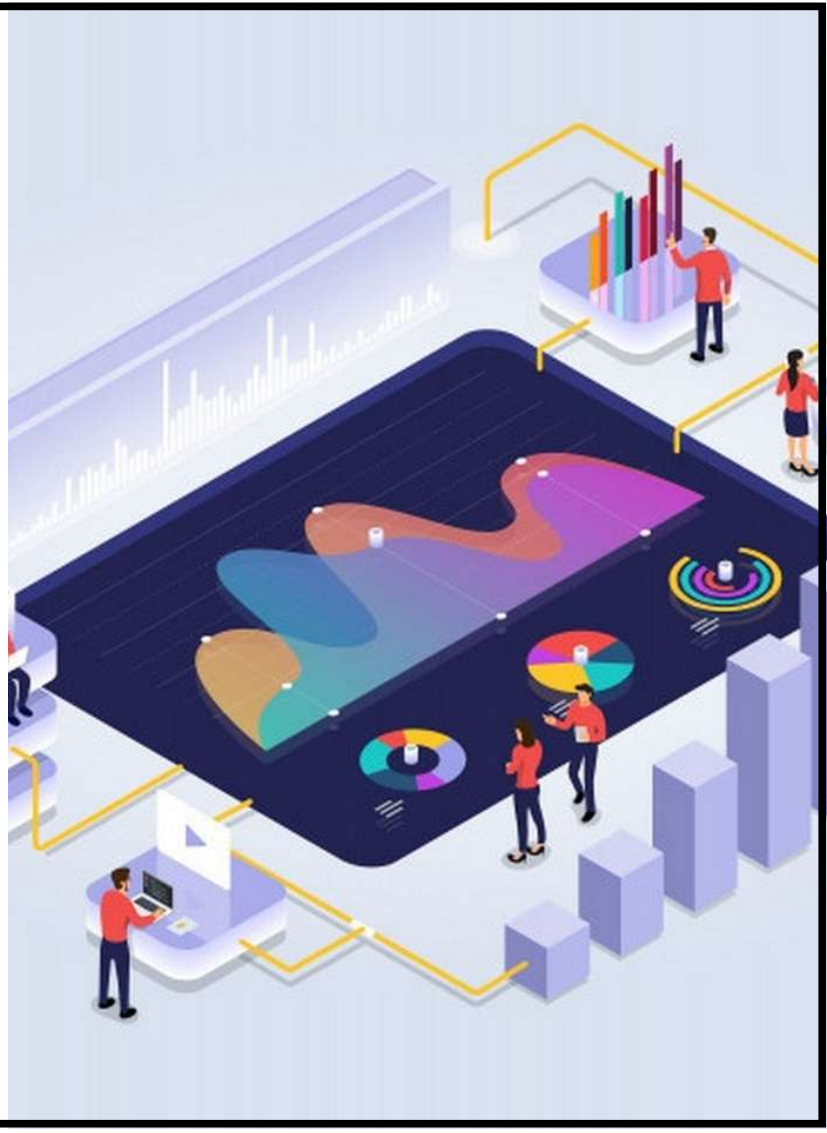
Key Components of CBIS

1. **Hardware:** Computers, Servers, Devices, Network Equipment etc.
2. **Software:** Operating Systems, Databases, Productivity Tools
3. **Data:** Text, Numbers, Images, Videos
4. **People:** Managers, Staff, Users
5. **Procedures:** Rules, Policies, Protocols
6. **Networks:** Internet, Intranet

Computer-Based Information Systems

Examples of CBIS

- **Transaction Processing Systems (TPS):** Point-of-Sale Systems in Supermarkets
- **Management Information Systems (MIS):** Monthly Sales Reports for Managers
- **Enterprise Systems (ERP):** SAP/Oracle for Integrated Business Operations

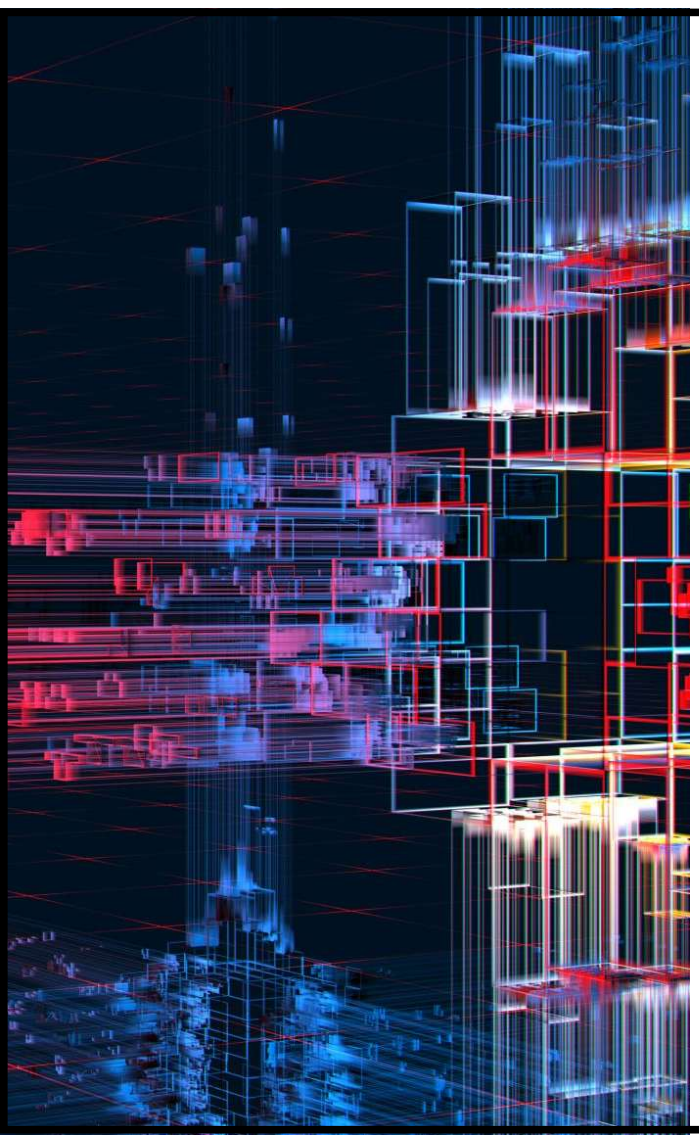


Computer-Based Information Systems

Benefits of CBIS

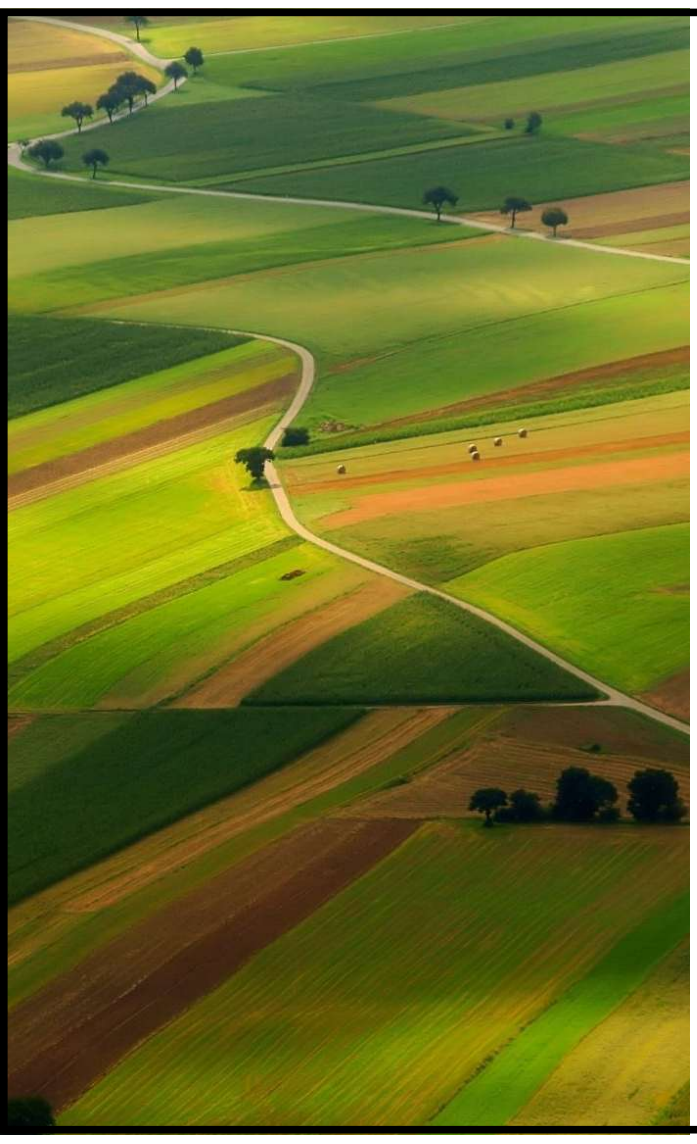
- **Efficiency:** Automate Repetitive Tasks, Improving Productivity
- **Accuracy:** Reduce Human Error in Data Entry and Processing
- **Data Integration:** Facilitate Information Sharing Across Departments
- **Better Decision-Making:** Provide Real-Time Data for Informed Decisions

Some Future Areas of ICT



Some Future Areas of ICT

- **Quantum Computing:** Revolutionizing computing with unprecedented processing power
- **5G and Beyond:** Advancing communication technologies for faster, more reliable connections
- **AI and IoT Integration:** Transforming industries with intelligent, connected devices



Conclusion

- It is a dynamic and exciting field with many applications and career paths
- Keep learning, exploring, and creating to stay ahead in this rapidly evolving field

Thank You !