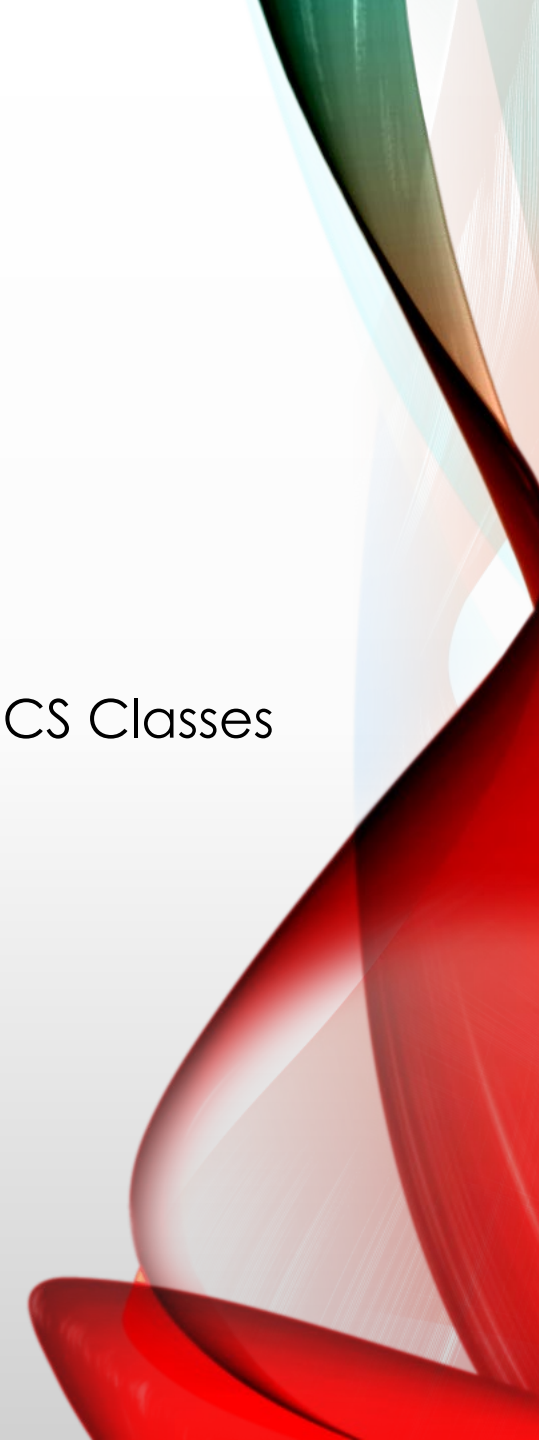
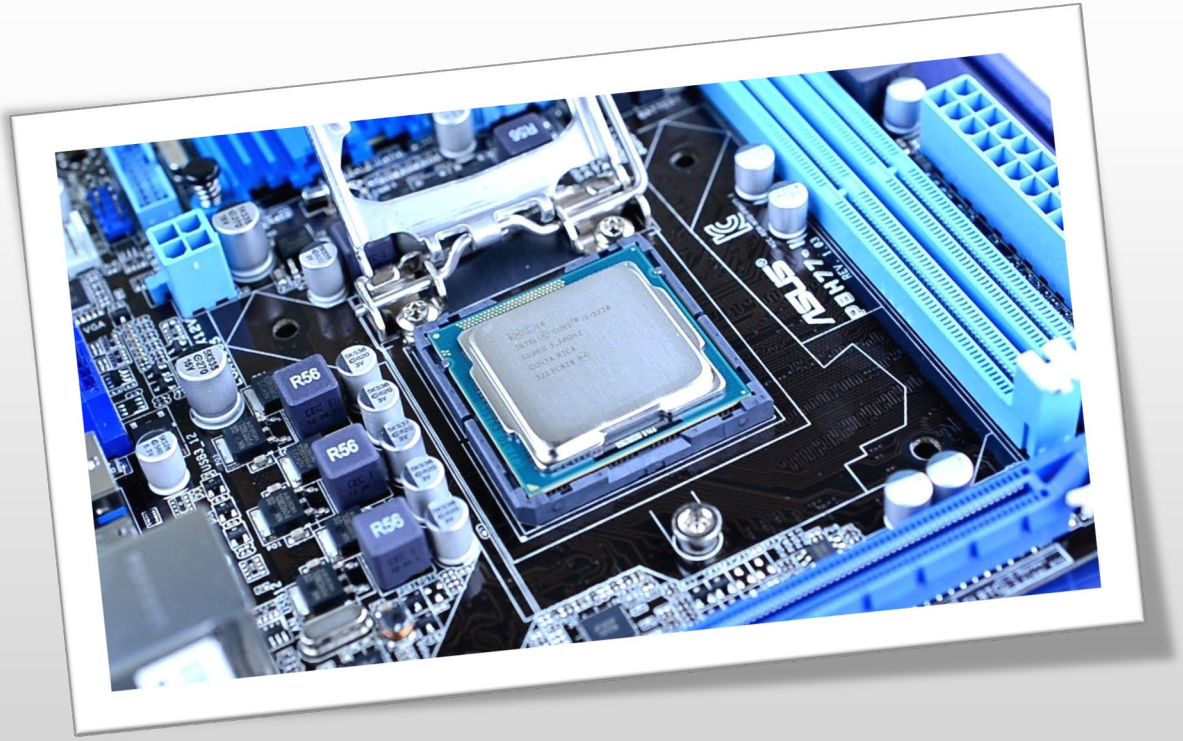
JCHS CSRL CROSSCUT STANDARDIZATION

2023-2024 All CS Classes



HARDWARE

- It is critical for programmers to understand the hardware on which their programs will run. Failure to do so can lead to significant errors and even security vulnerabilities.

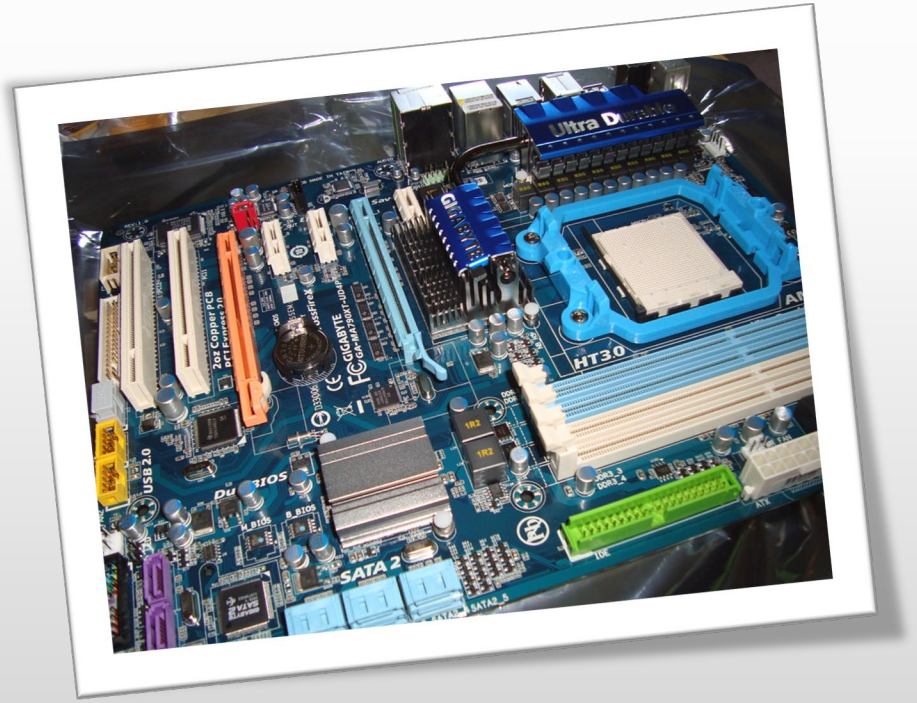


COMPUTER

- A general-purpose electronic device that can perform various tasks by executing programs and processing data.

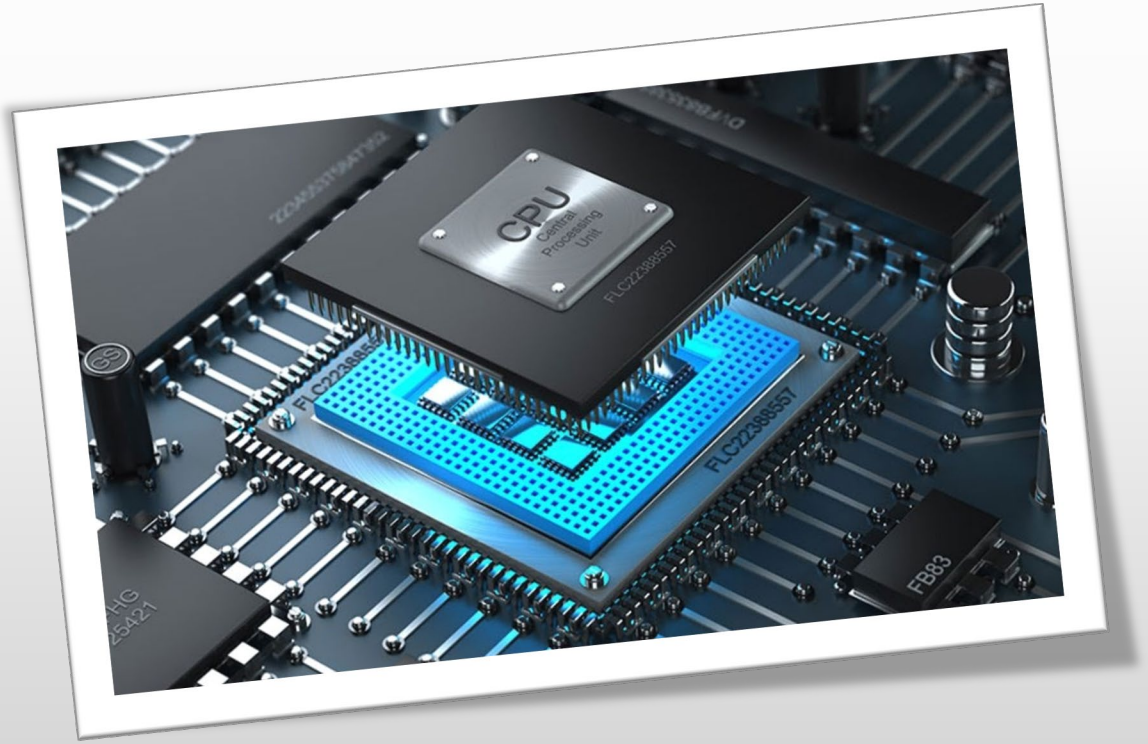
MOTHERBOARD

- The main circuit board of a computer that contains the central processing unit (CPU), memory, and connectors for other hardware components.



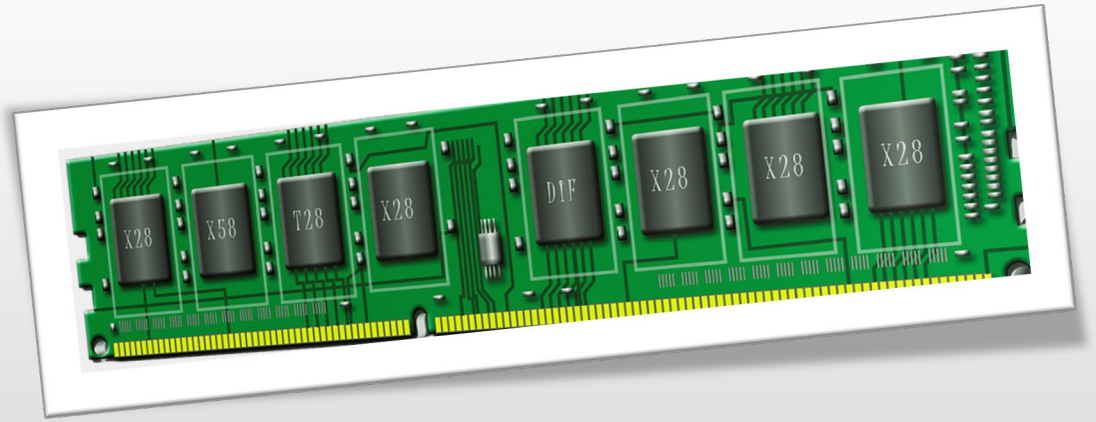
CPU

- Central Processing Unit: The primary component of a computer that executes instructions from programs, performing arithmetic, logical, control, and input/output operations.



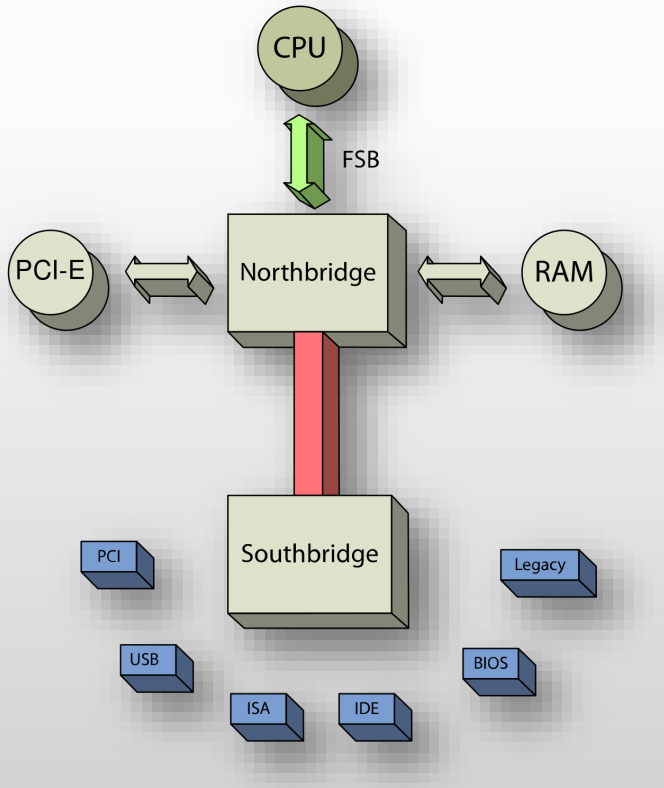
RAM

- Random Access Memory: A volatile memory used by a computer's operating system and applications to temporarily store data that can be quickly accessed and modified.



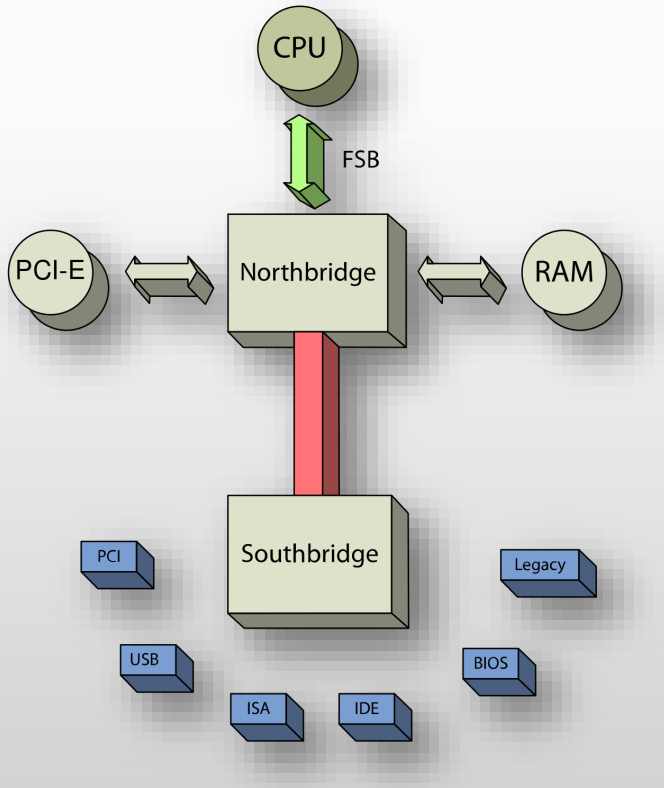
NORTHBRIDGE

- Northbridge: A chipset component that connects the CPU to high-speed communication channels like RAM and the graphics card.



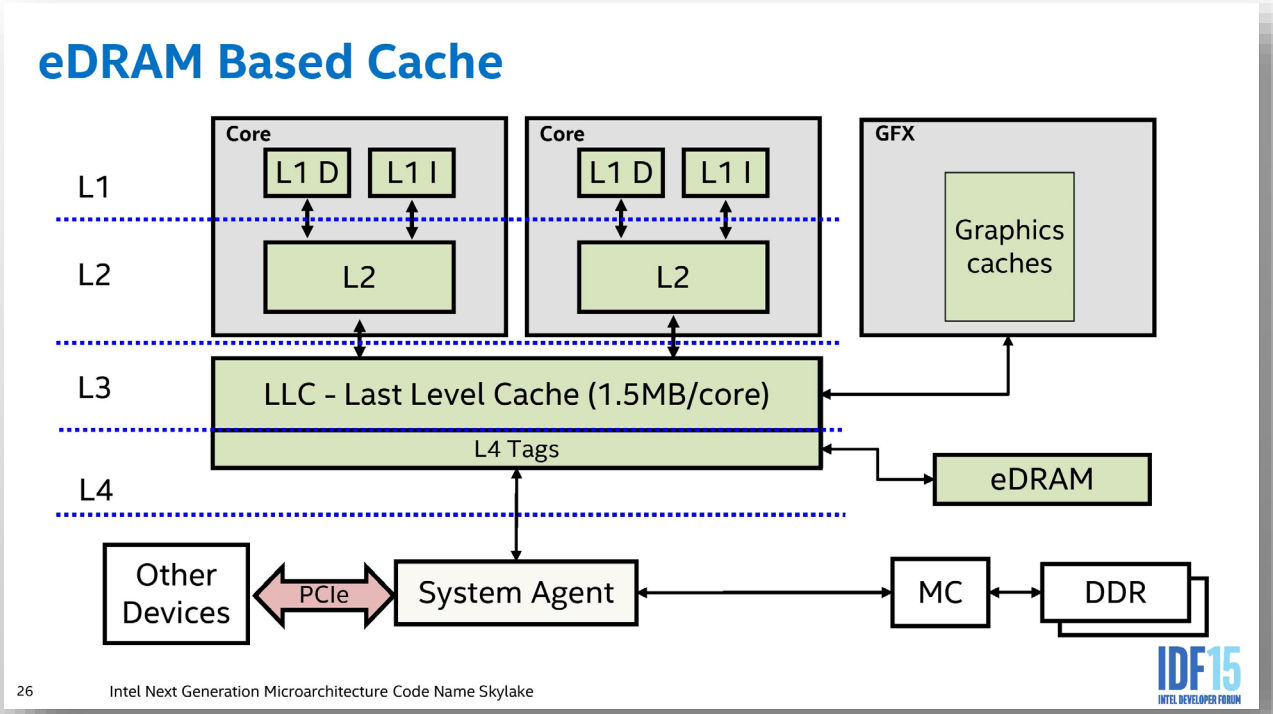
SOUTHBRIDGE

- Southbridge: Manages lower-speed communication channels such as USB, SATA, and PCI on a computer's motherboard.



CACHE

- Cache: Small, high-speed volatile memory that stores frequently used instructions and data to reduce the time needed to access them from slower main memory.

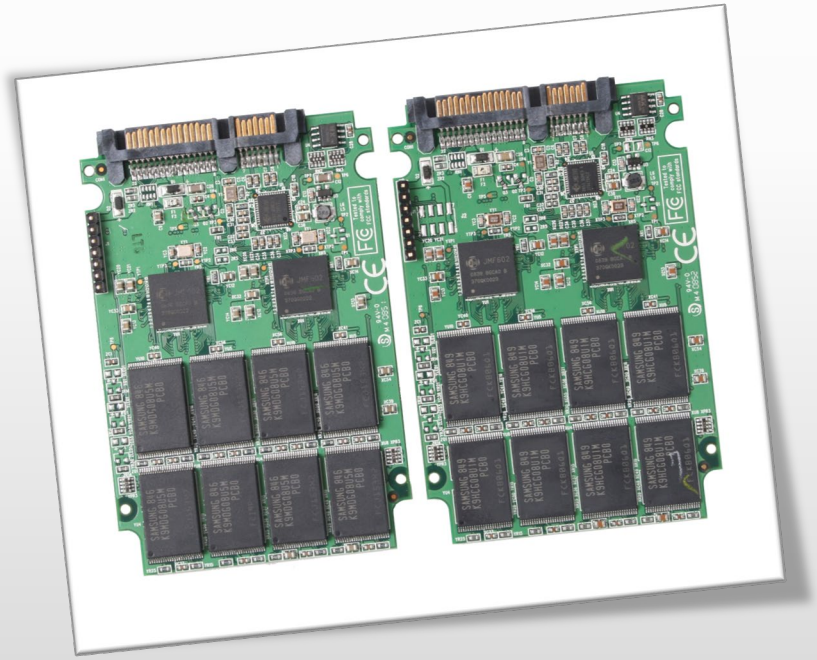


HDD

- Hard Disk Drive: A data storage device that uses spinning disks to store data magnetically on a platter, offering larger storage capacities but slower access times compared to SSDs.

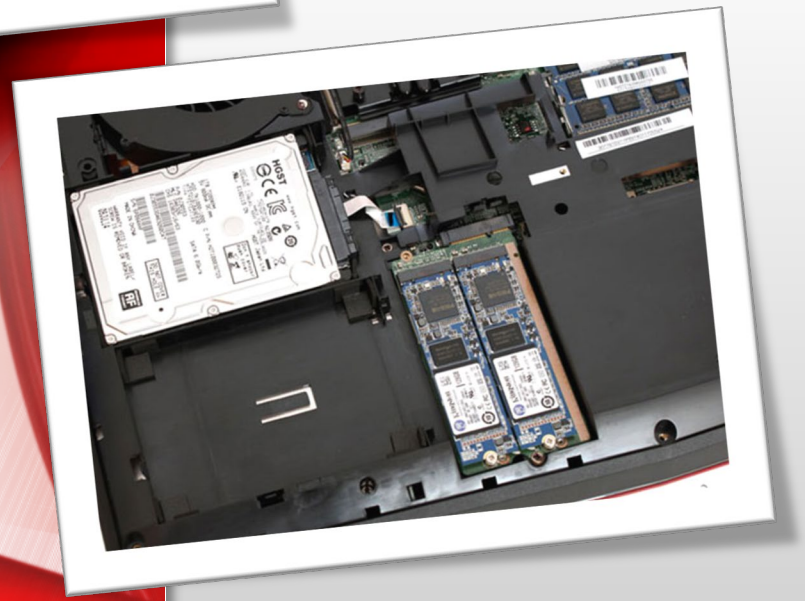
SSD

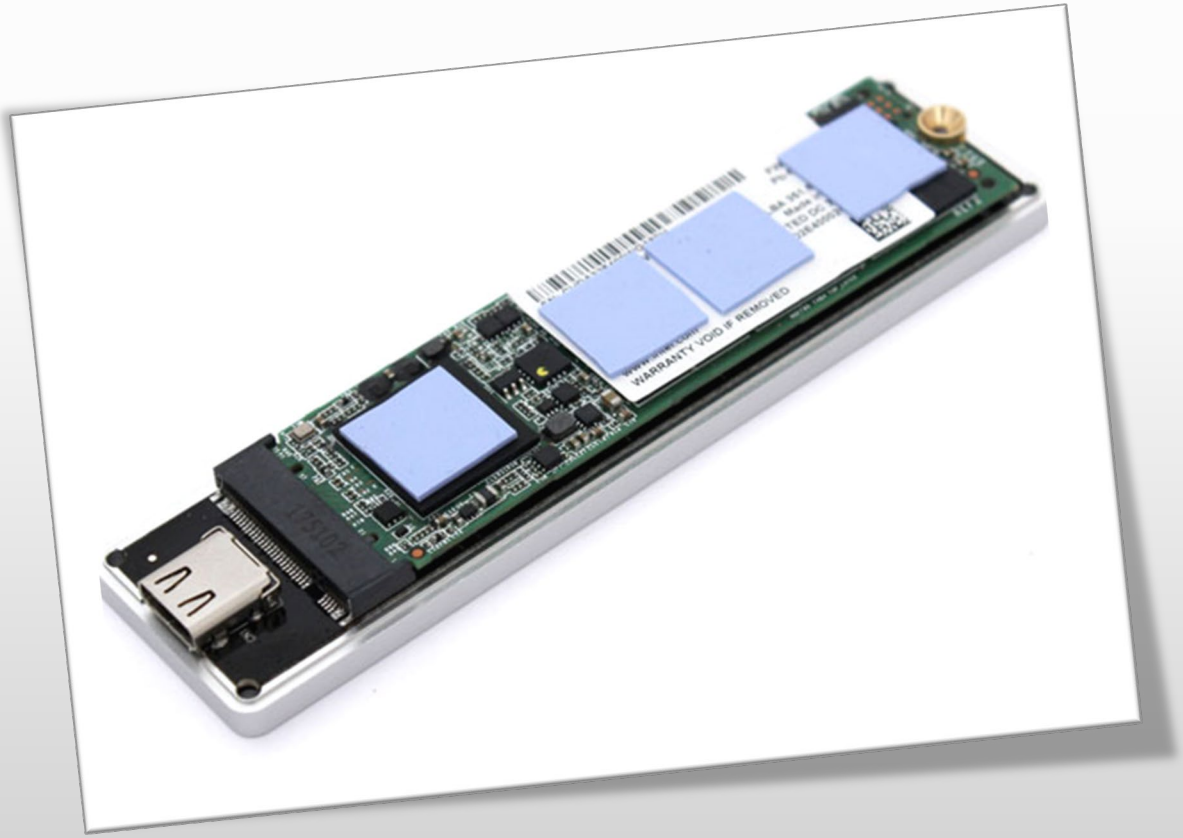
- Solid State Drive: A data storage device that uses NAND-based flash memory to store data electronically, providing faster access times and improved durability compared to HDDs.



M.2

- M.2 SSD: A small form factor for SSDs and other expansion cards that uses a faster and more efficient interface compared to traditional SATA connections.





MEMORY

A HISTORICAL LOOK AT HOW COMPUTERS RETAIN DATA

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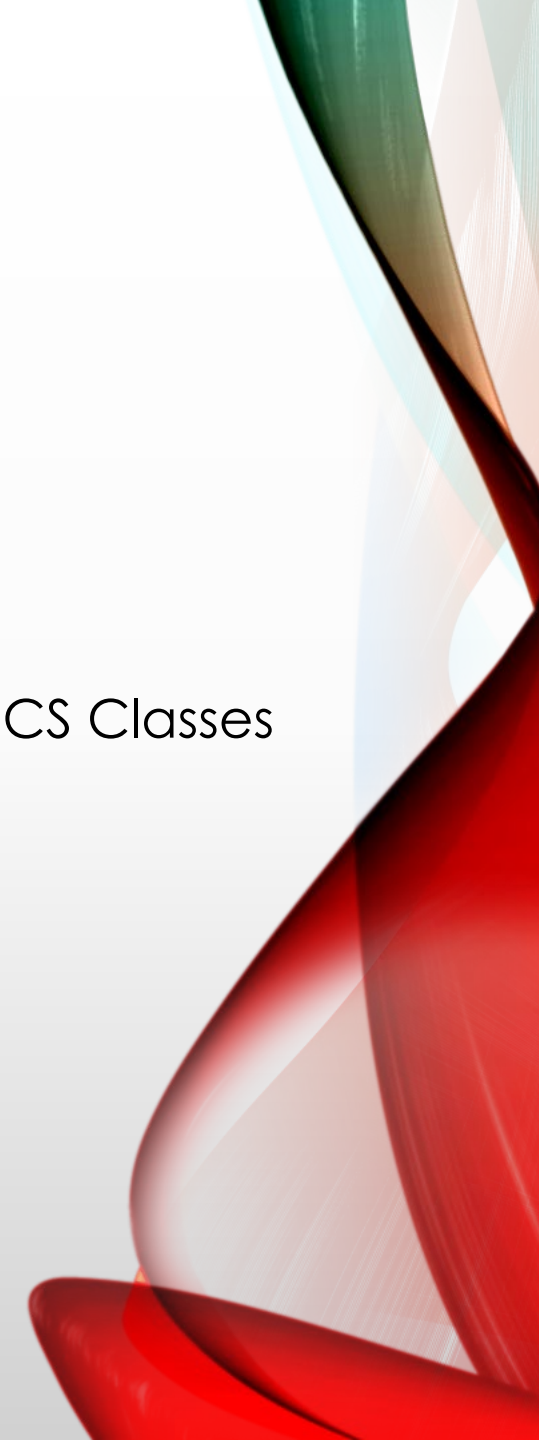
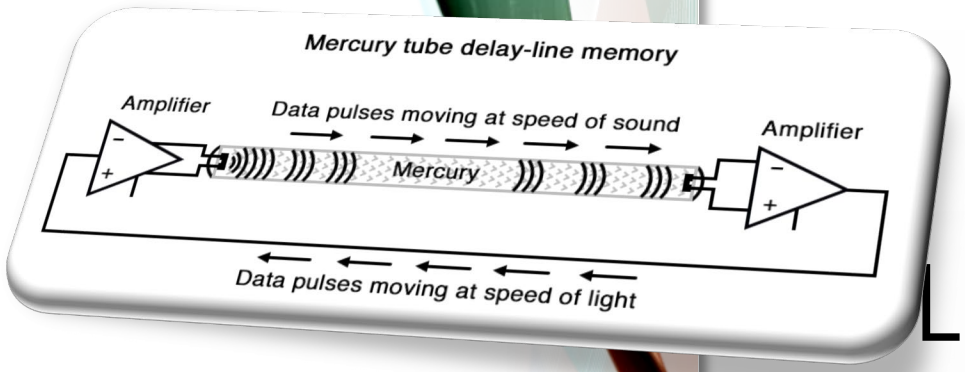


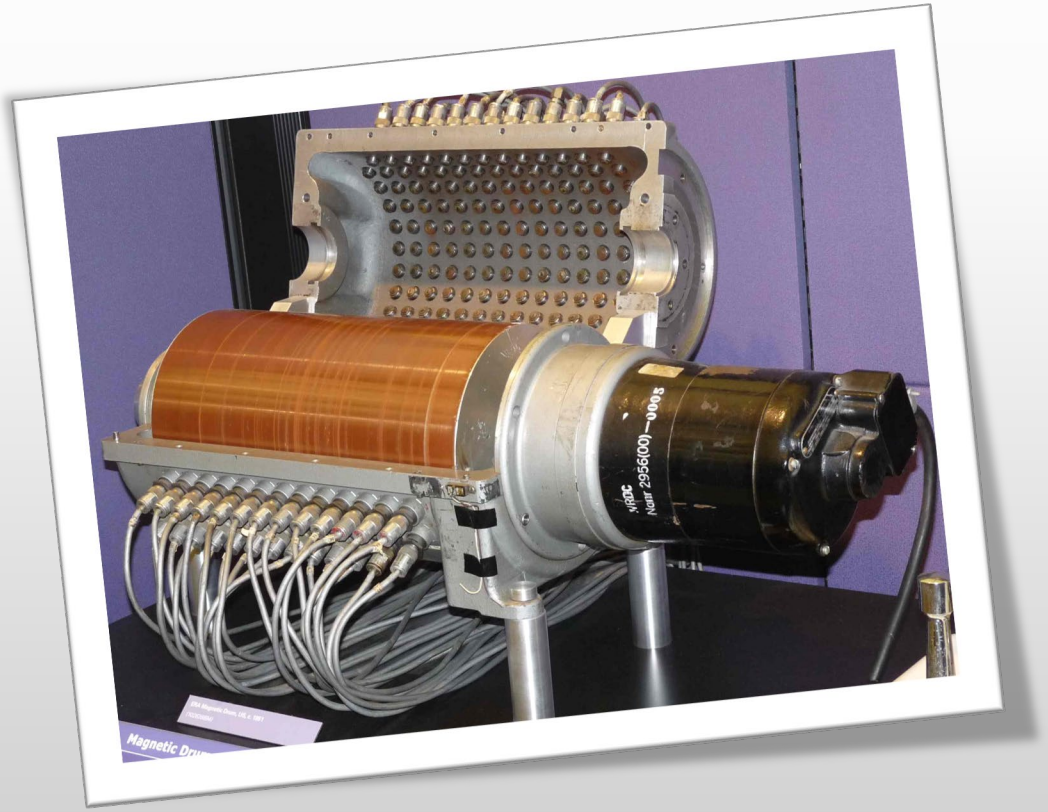


VACUUM TUBES AND DELAY LINE MEMORY (1940s – 1950s)

- Early Machines like ENIAC and UNIVAC systems
- Used vacuum tubes to perform calculations and store small amounts of data temporarily
- Delay Line memory used sound waves in mercury-filled tubes to store data for short periods

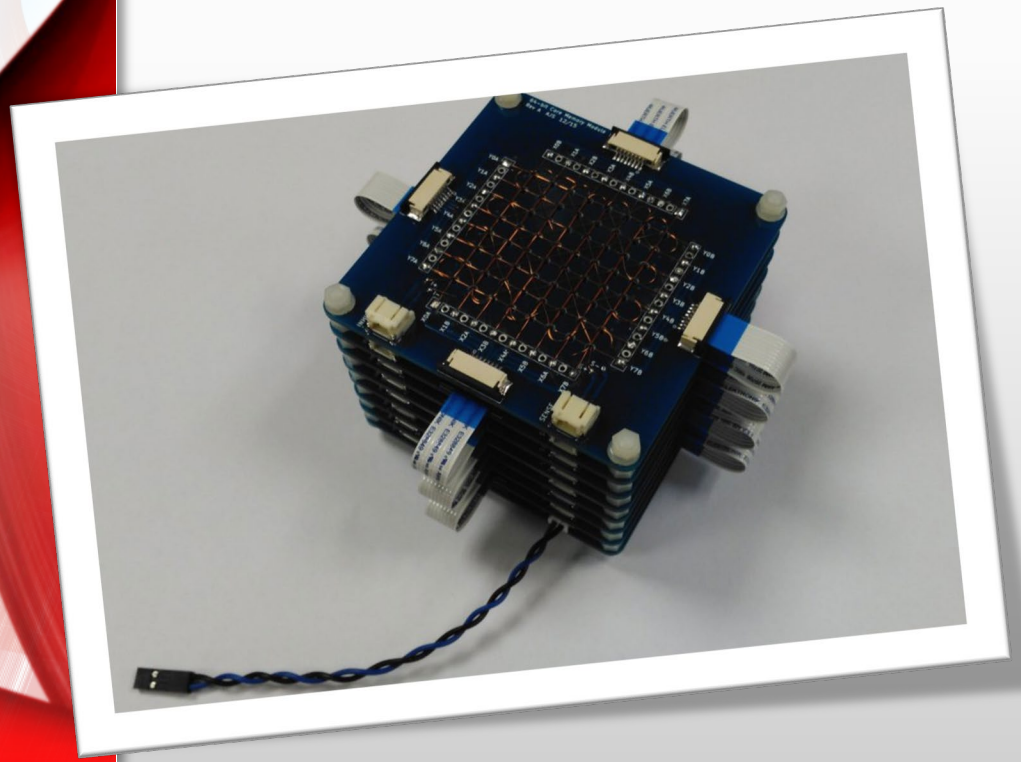
MAGNETIC DRUM MEMORY (1950s – 1960s)

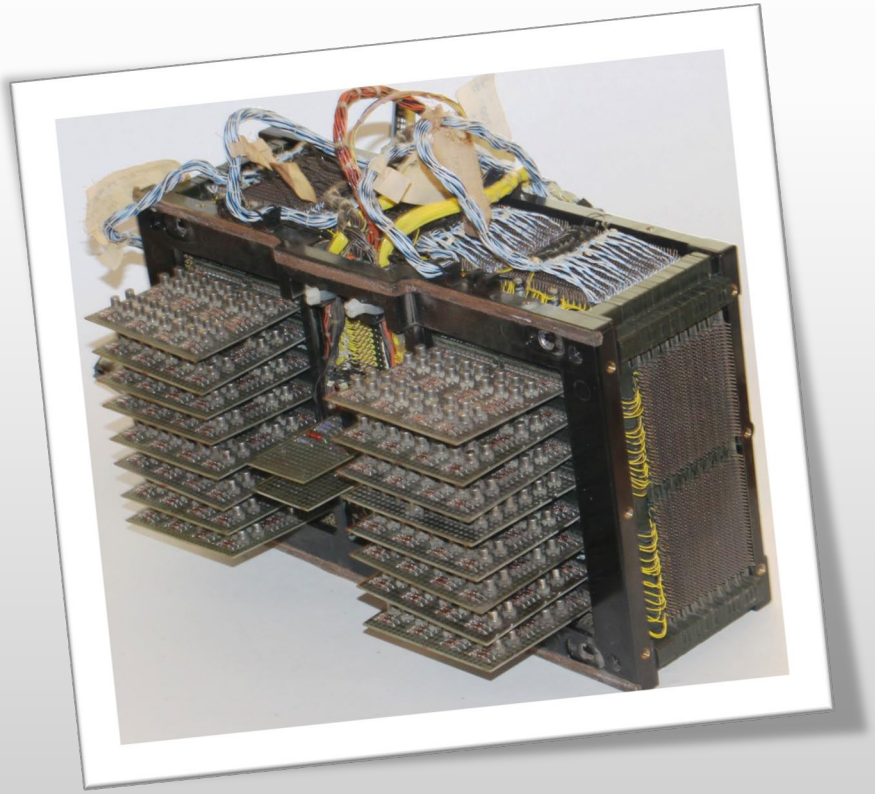
- Rotating cylinder coated with magnetic material. Data stored in the form of magnetized spot on the drum's surface.



CORE MEMORY (1950s – 1970s)

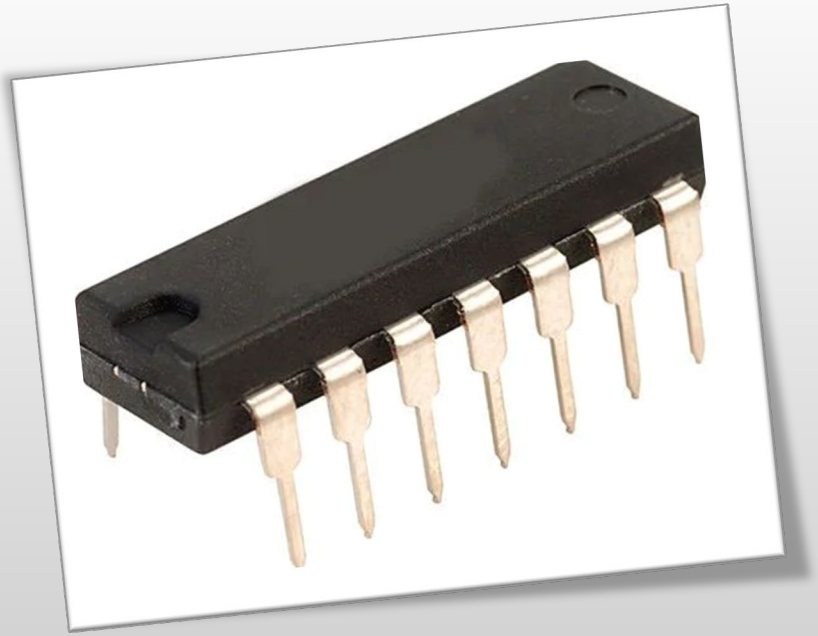
- Tiny magnetic rings, or cores, to store bits of data. When a current flowed through a core, it could be magnetized in one of two directions to represent 0 or 1.
- Core memory was reliable and widely used in early computers, including minicomputers and mainframes.





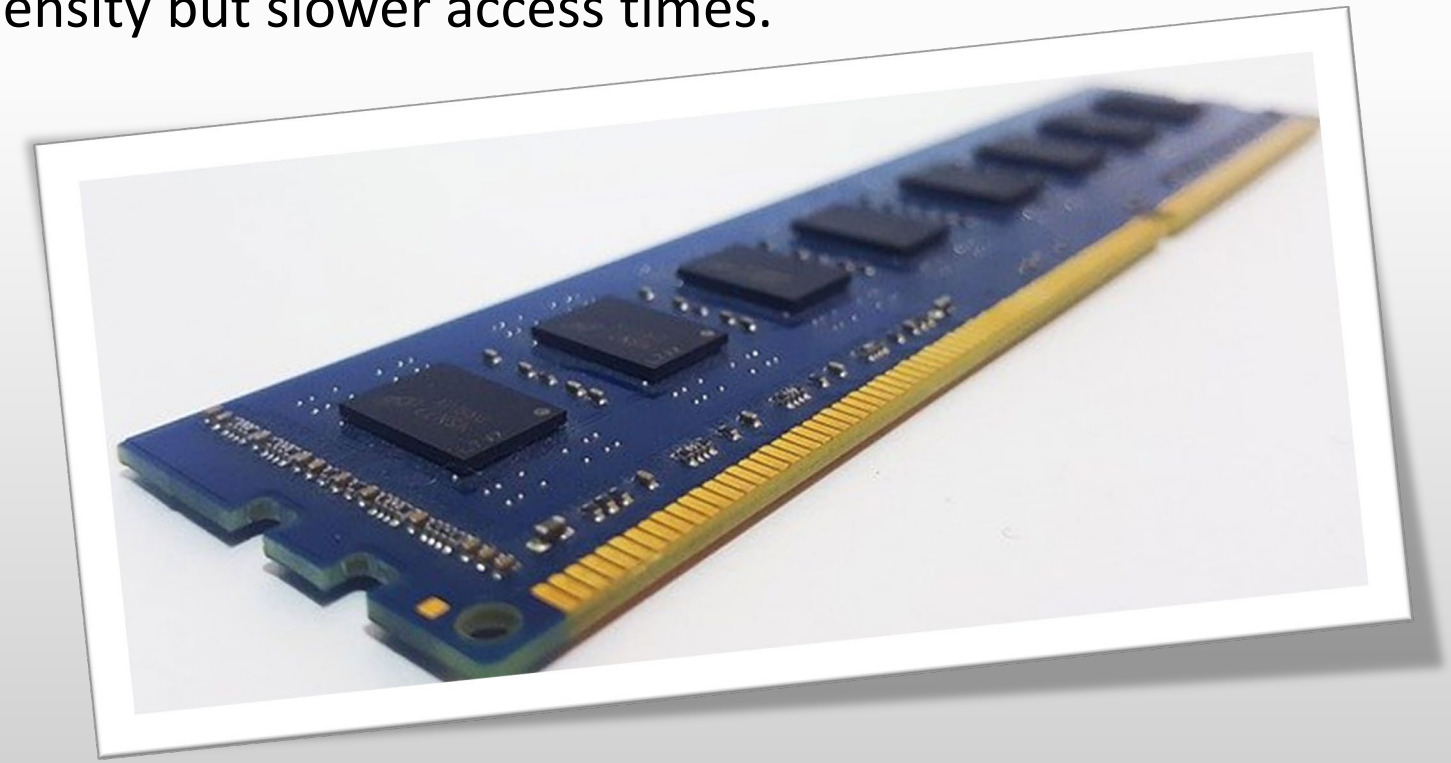
IC MEMORY (1960s – NOW)

- The invention of integrated circuits (ICs) marked a significant advancement. ICs allowed multiple transistors, capacitors, and resistors to be integrated onto a single chip of semiconductor material.
- Early memory ICs were used in computers and other devices, leading to smaller, more efficient memory solutions.



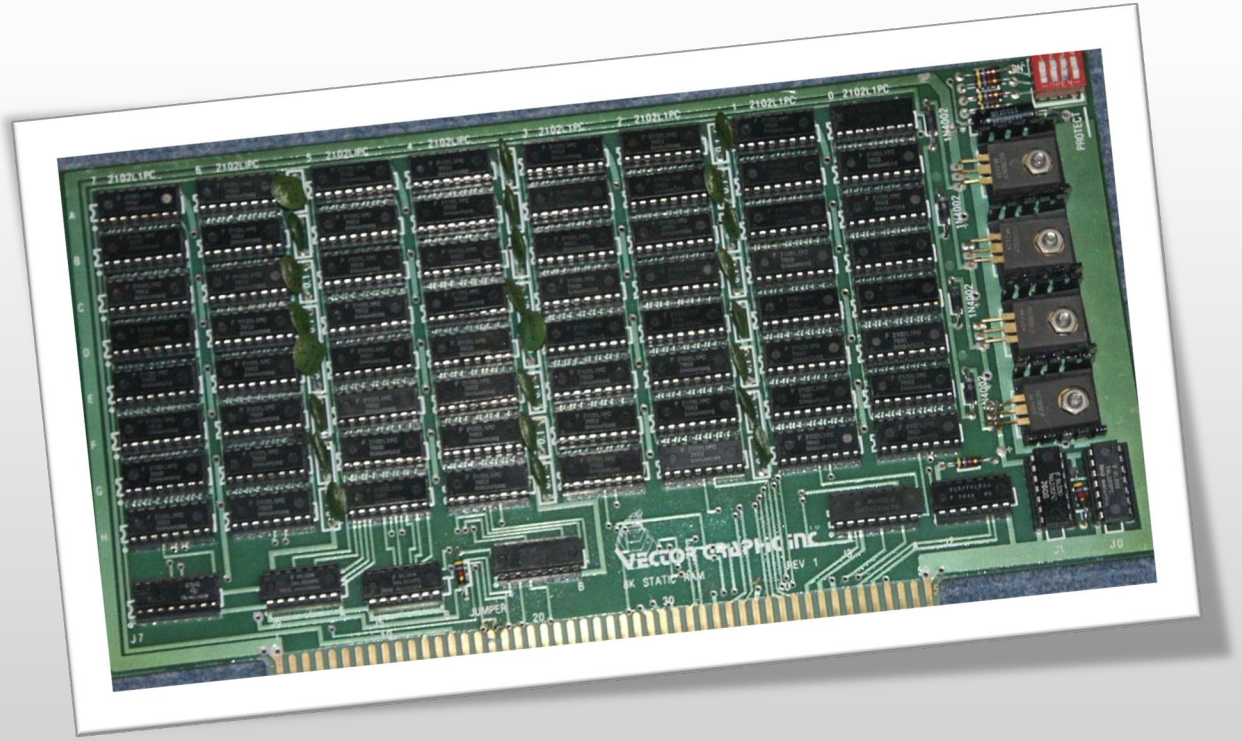
DYNAMIC RAM (DRAM) MEMORY (1970S – NOW)

- DRAM uses capacitors to store data, which must be refreshed regularly to prevent data loss. It offers higher density but slower access times.



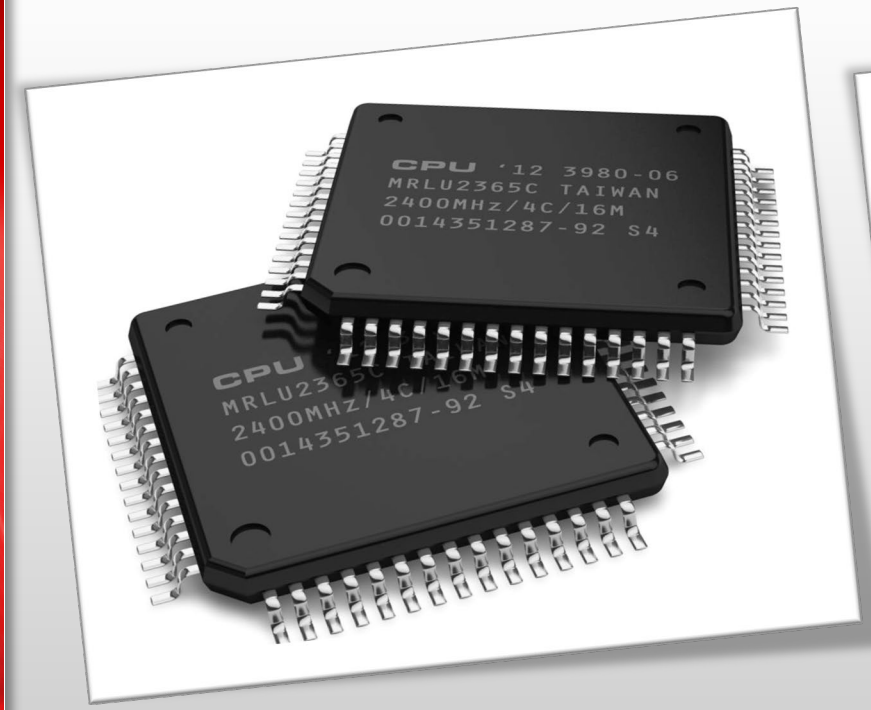
STATIC RAM (SRAM) MEMORY (1970s – NOW)

- SRAM uses flip-flops to store data and doesn't require constant refreshing. It's faster but less dense compared to DRAM.



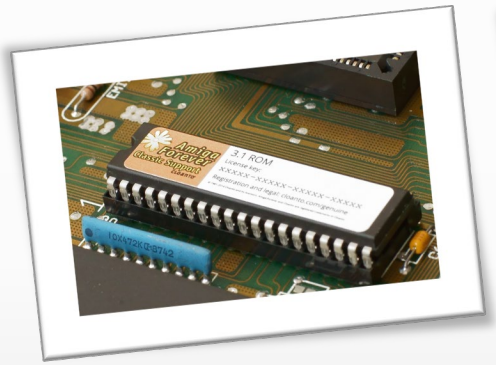
FLASH MEMORY (1970s – NOW)

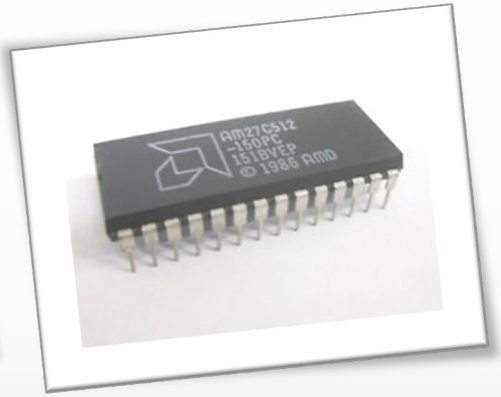
- Flash memory is non-volatile and can retain data even when power is turned off. It's used in devices like USB drives, memory cards, and SSDs.
- NAND and NOR flash are two common types, with NAND being more prevalent in mass storage devices.

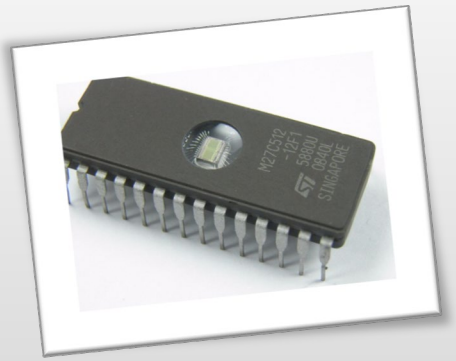


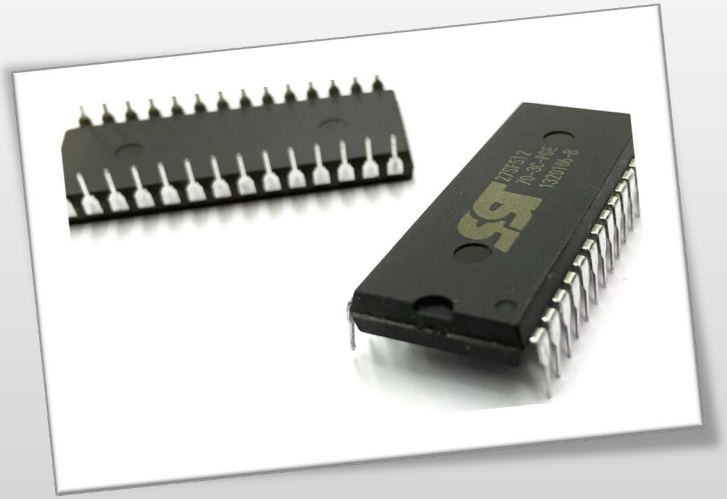
ROM-TYPE MEMORY (1970s – NOW)

Read Only Memory	Definition	Notes
ROM	**R**ead **O**nly **M**emory	Permanent at Point of Manufacture
PROM	**P**rogrammable **R**ead **O**nly **M**emory	Post Manufacture Burn thence Permanent
EPROM	**E**rasable **P**rogrammable **R**ead **O**nly **M**emory	UV Erasable to Re-Program
EEPROM	**E**lectrically **E**rasable **P**rogrammable **R**ead **O**nly **M**emory	Electrically Reprogrammable, User Friendly



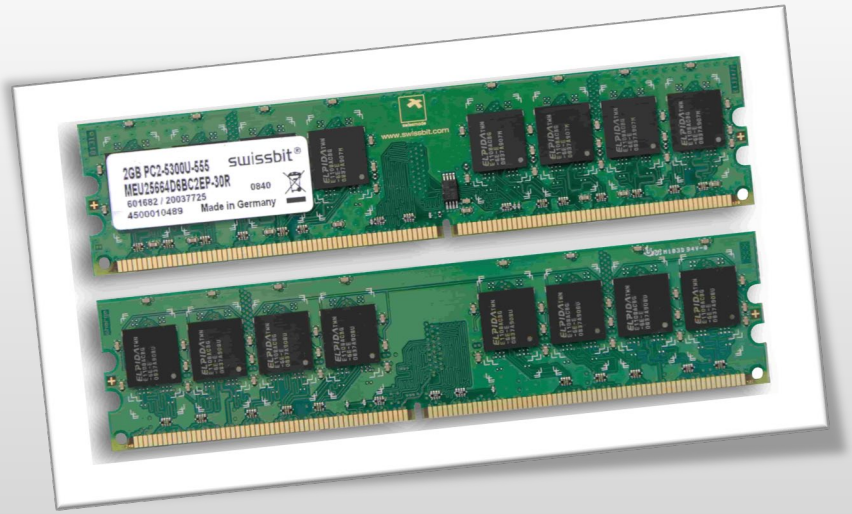


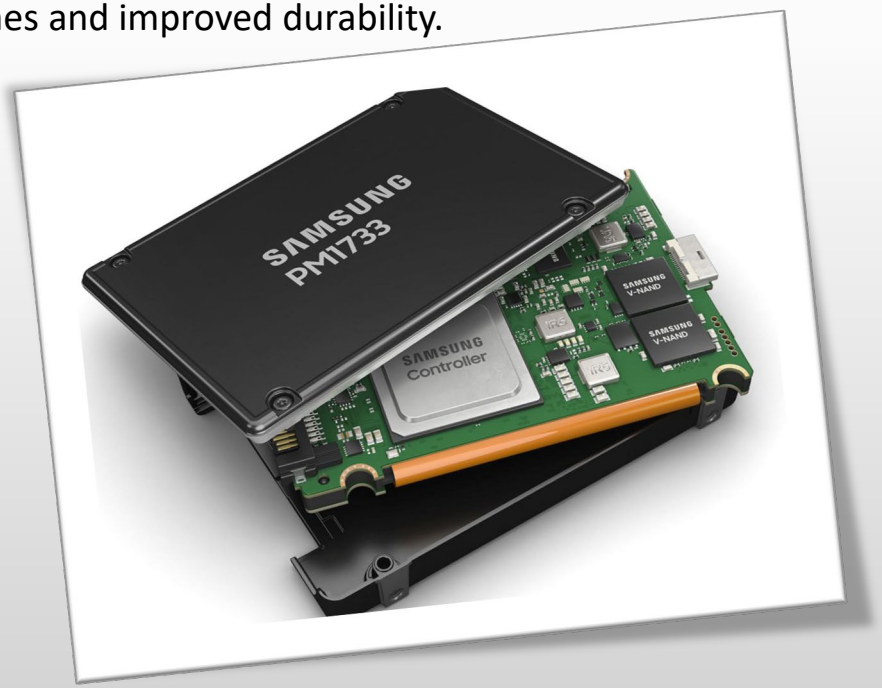


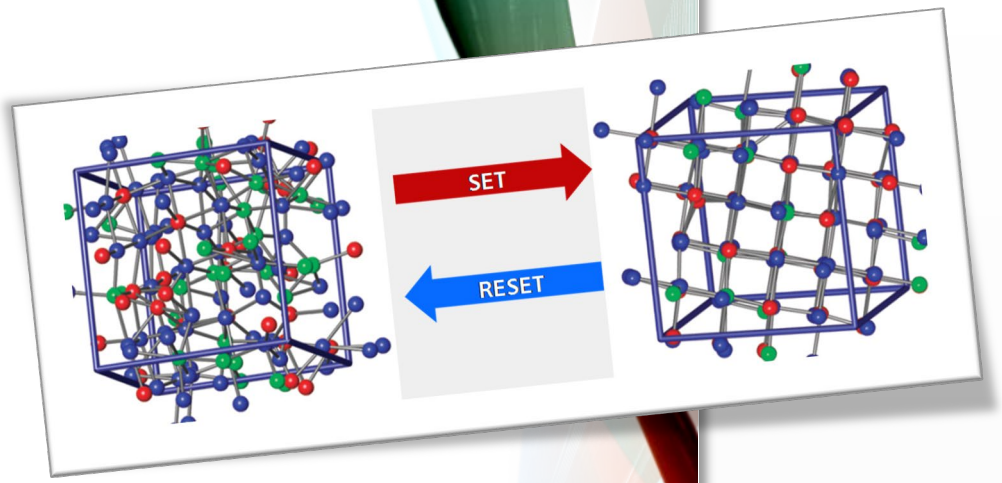


DOUBLE DATA RATE SYNCHRONOUS DYNAMIC RAM (DDR SDRAM) MEMORY (1970s – NOW)

- Common RAM used in computers today. It offers higher speeds and efficiency compared to earlier forms of RAM.
- Solid-state drives (SSDs) have gained popularity as a replacement for traditional hard disk drives (HDDs), providing faster access times and improved durability.

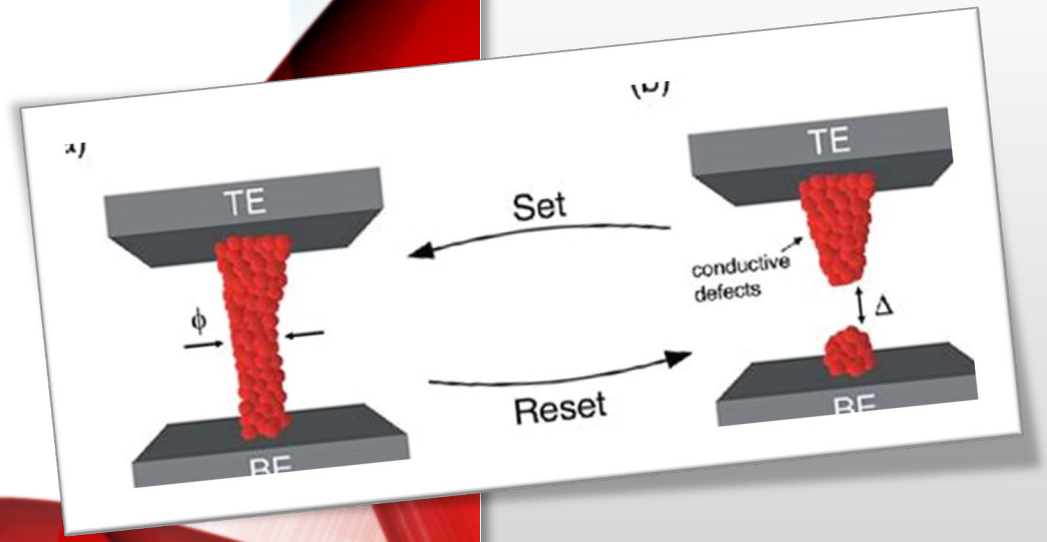


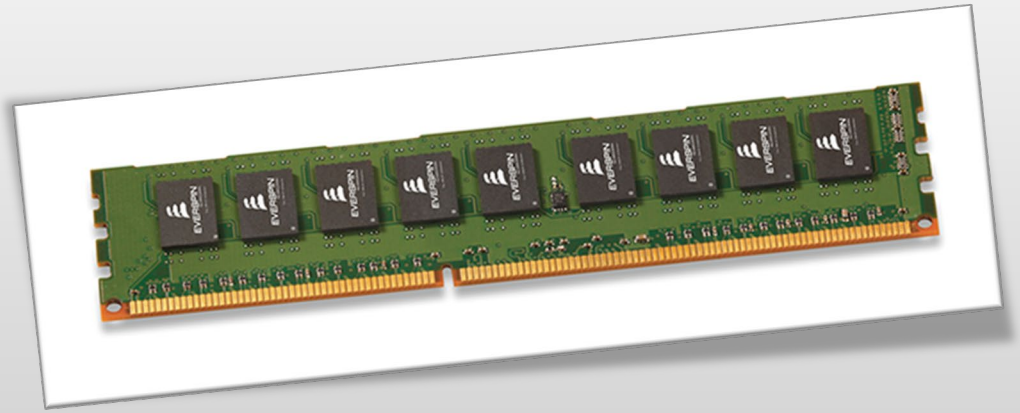




EMERGING MEMORY TECH (FUTURE)

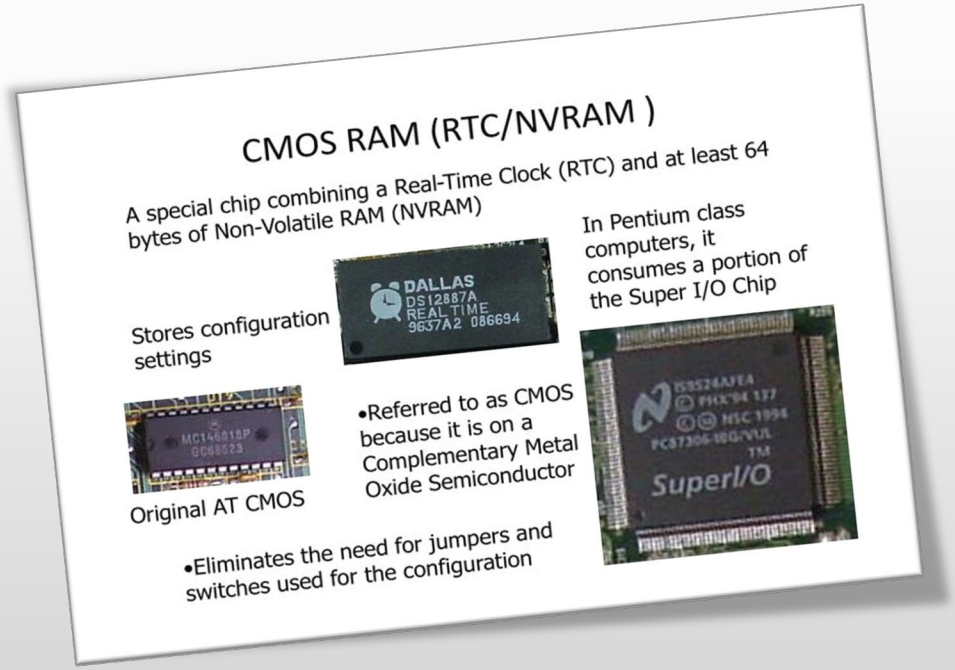
- Researchers are exploring new memory technologies like phase-change memory (PCM), resistive RAM (ReRAM), and magnetic RAM (MRAM) for faster, more energy-efficient storage.





CMOS RAM

- Complementary Metal Oxide Semiconductor RAM (chip) on motherboard.
- Holds Basic Input Output System (BIOS) Settings
- ROM or Flash

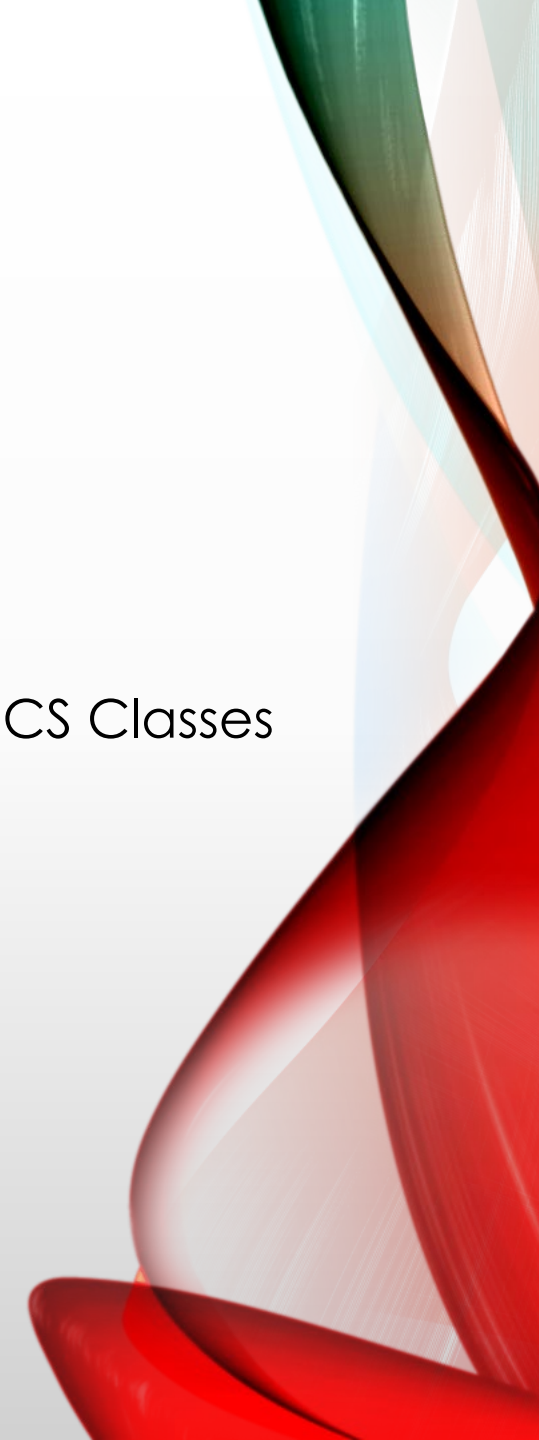


CMOS BATTERY

- Powers Real-Time Clock (RTC)
- Maintains Basic Input Output System (BIOS) Settings
- Stores System Config
- Checksums of BIOS settings and Security
- BIOS Updating and Booting

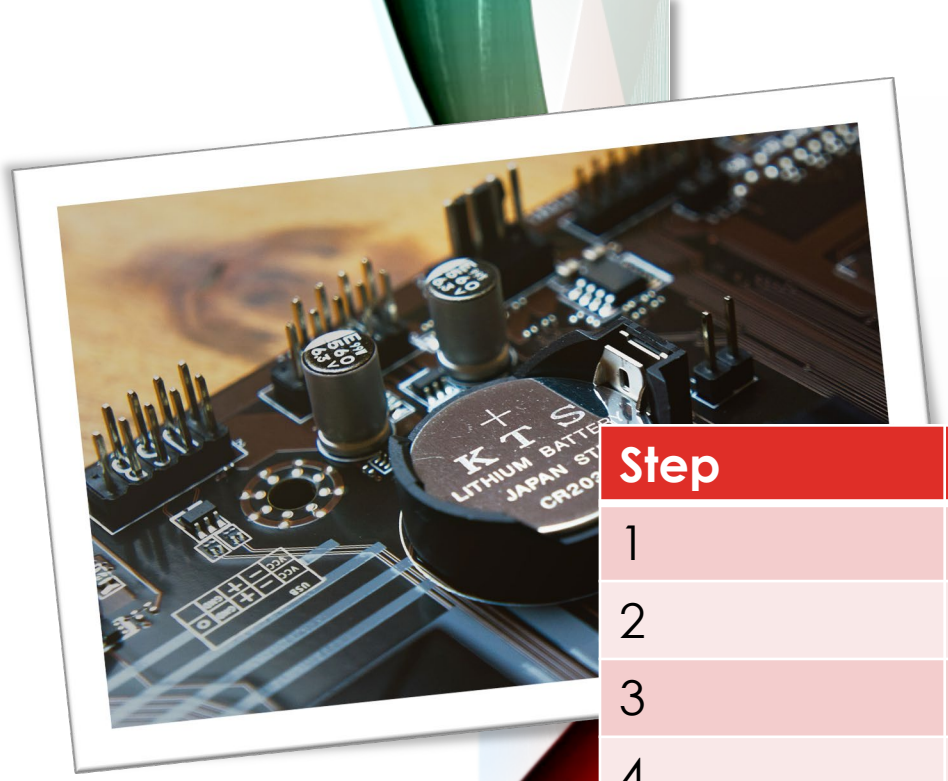
“ON”
POWERING UP

2023-2024 All CS Classes



BIOS/UEFI

Firmware	Description
BIOS	**B**asic **I**nput **O**utput **S**ystem
	Provides **fundamental instructions** and **settings** required for the computer's hardware to initialize and communicate with the operating system and other software. It plays a **crucial role during the boot process** and **ensures** that the **hardware components are properly configured and functioning** before the operating system starts.
UEFI	**U**nified **E**xtensible **F**irmware **I**nterface
	Modern replacement for the traditional BIOS firmware. UEFI offers a **more advanced and flexible** interface between the computer's firmware and the operating system. It **supports a graphical user interface (GUI), allowing users to interact with firmware settings using a mouse and keyboard.** UEFI also provides **improved security** features, **faster boot** times, support for **larger storage devices**, and **better compatibility** with modern hardware.
	BIOS, as a term, can refer to *both* BIOS and UEFI



STARTUP SEQUENCE

Step	Description
1	Power-On Self-Test (POST) starts.
2	BIOS (or UEFI) initialization and hardware check.
3	Boot device selection based on BIOS settings.
4	Boot loader execution to load operating system.
5	Operating system kernel loading into memory.
6	Device initialization, including drivers and controllers.
7	System initialization of services and background processes.
8	User login screen (if required).
9	User desktop environment loading.
10	User interaction and application usage.