

# Lecture 02

## Introduction to the Personal computer- PII

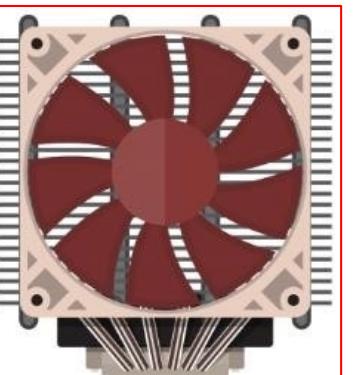
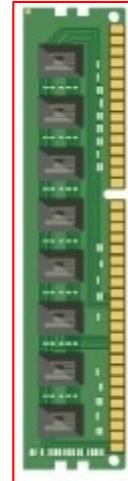
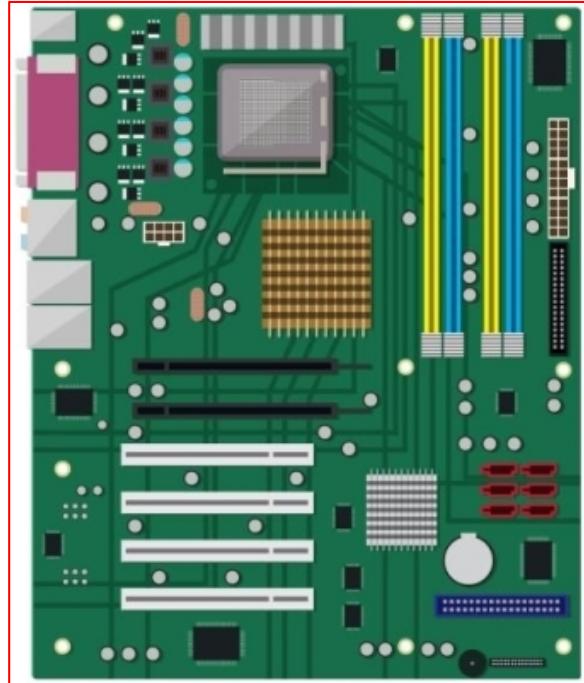
CT4005NI - Computer Hardware and Software Architectures

# Lecture 02's Objectives

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- Describe a computer system.
- Concept of CPU and different types of CPU socket.
- Advance features of CPU,
- Concept of Computer Memory,
- Classification of RAM,
- Internal components of Motherboard.

# Recap : Internal components



# Recap

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- Module description
- IT Certifications
- Computer case and their firmware:- **Mini-ITX, Micro-ATX, ATX and EATX**
- Power Supply Units and their power connectors:- **P1 24-pin, 4-Pin Molex and Mini Molex (Berg), 15-pin SATA, 6/8-pin PCIE and 4-pin power connector**
- PSU color coding : (**orange:+3.3V, Red:+5V, White:-5V, yellow:+12V, blue:- -12V**)
- Internal components: **Hard disks, RAM, Adapter cards, motherboard**
- Motherboard components: **CPU Sockets, RAM slot, PCI Slots, SATA/PATA ports, power connector ports, chipsets, I/O ports, CMOS and so on.**

## 2.1 Internal Components : CPU

- The central processing unit (CPU) is considered the **brain** of the computer.
- Most calculations take place in the CPU.
- CPUs come in different form factors, each style requiring a particular slot or socket on the motherboard.

Intel



AMD



## 2.1 Internal Components : CPU

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- Unlike Slot-based processors, most CPU sockets and processors in use today are built around the **Pin Grid Array (PGA)** architecture, in which the pins on the underside of the processor are inserted into the socket, usually with **Zero Insertion Force (ZIF)**.
- The CPU executes a sequence of stored instructions called a Program.



## 2.2 Motherboard Components : CPU Sockets

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- A CPU socket is the place where we actually place a CPU in the Motherboard.
- They are commonly either **LGA** or **PGA** with a **ZIF** mechanism.
- Well known CPU manufacturers are **Intel** and **AMD**.

### Common Intel Sockets

- a. LGA 775
- b. LGA 1156
- c. LGA 1366
- d. LGA 1155
- e. LGA 2011
- f. LGA 1150

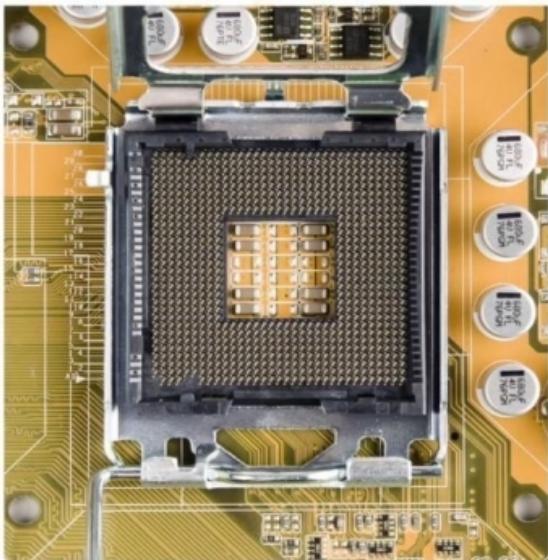
### Common AMD Sockets

- a. Socket AM2
- b. Socket AM3
- c. Socket AM3+
- d. Socket FM1
- e. Socket FM2
- f. Socket FM2+

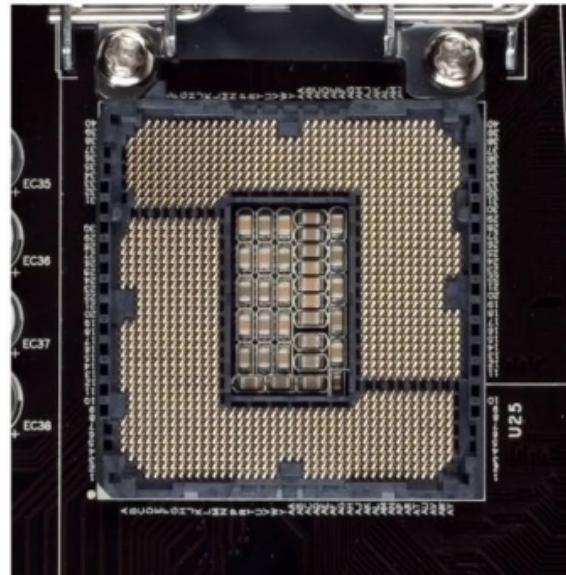
## 2.2 Motherboard Components : CPU Sockets

### Common Intel Sockets

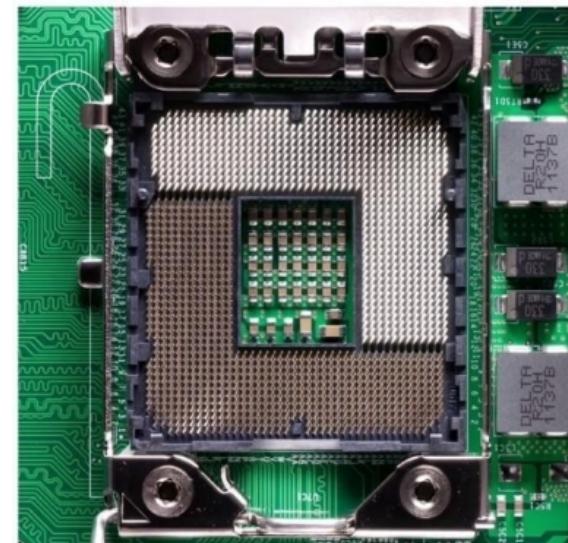
LGA 775



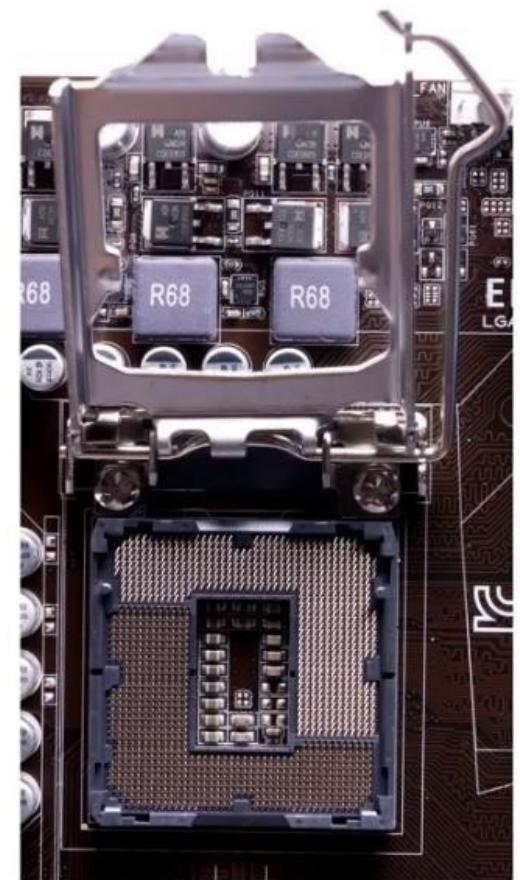
LGA 1156



LGA 1366



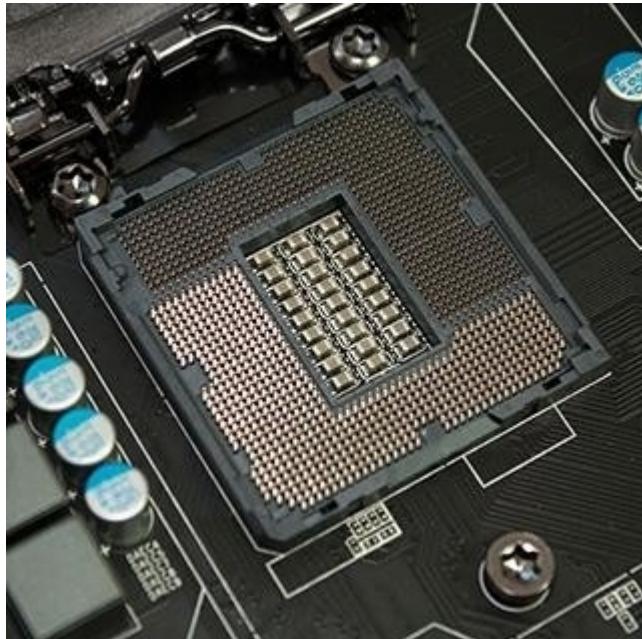
LGA 1155



## 2.2 Motherboard Components : CPU Sockets

### Common Intel Sockets

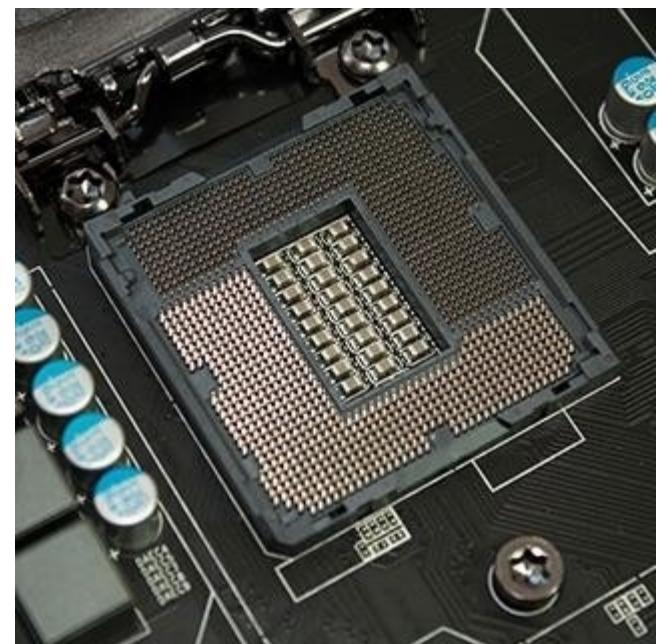
#### LGA 1150 (i3 CPU)



#### LGA 1155 (i5 CPU)



#### LGA 1150 (i7 CPU)



2nd Gen Sandy bridge uses LGA 1155  
3rd Gen Ivy Bridge uses LGA 1155  
4th gen Haswell uses LGA 1150  
5th Gen broadwell uses LGA 1150

## 2.3 CPU - Advanced Features

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- While the CPU is executing one step of the program, the other instructions and data are stored in **cache memory**.

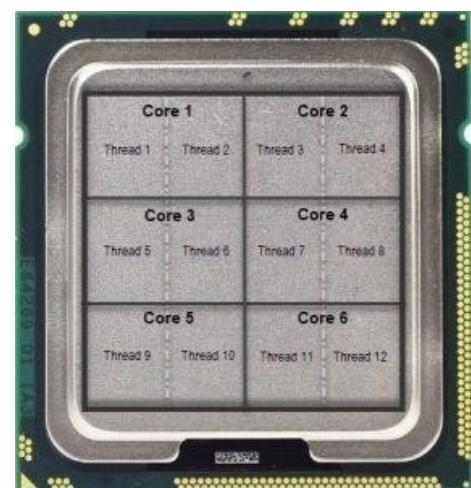
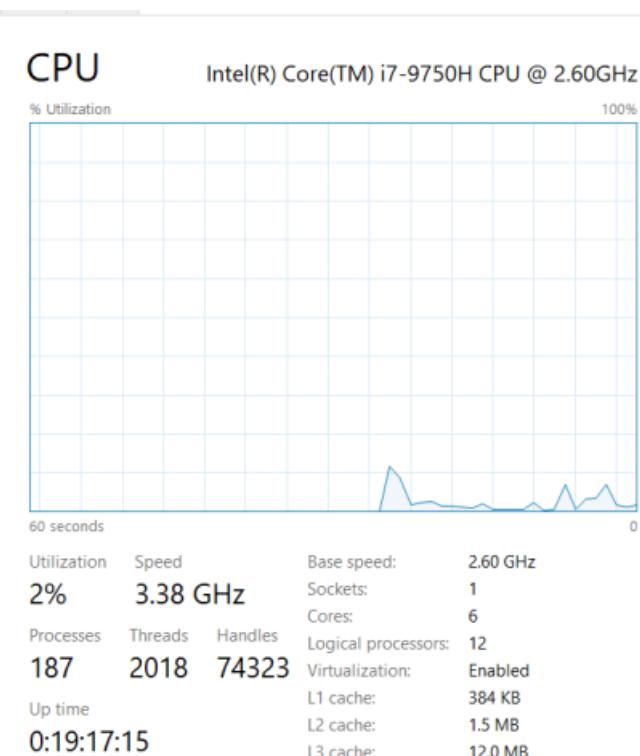
### CPU Architecture x86 and x64:

- x86 or 32 bit CPU architecture registers to store values of up to  $2^{32} = 4$  billion, 294 million, 967 thousand and 296
- x64 or 64 bit CPU architecture registers to store values of up to  $2^{64} = 18$  quintillion, 446 quadrillion, 744 trillion, 073 billion, 709 million, 551 thousand 616

## 2.3 CPU - Advanced Features

### Hyper threading

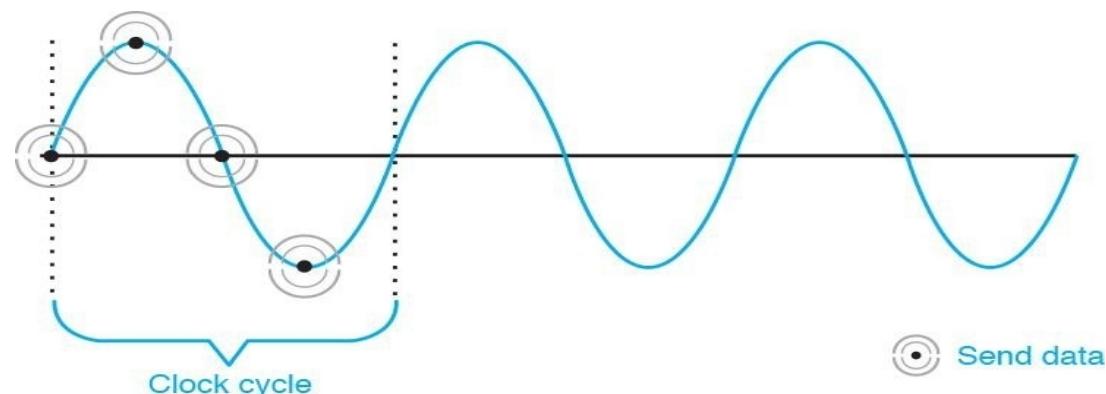
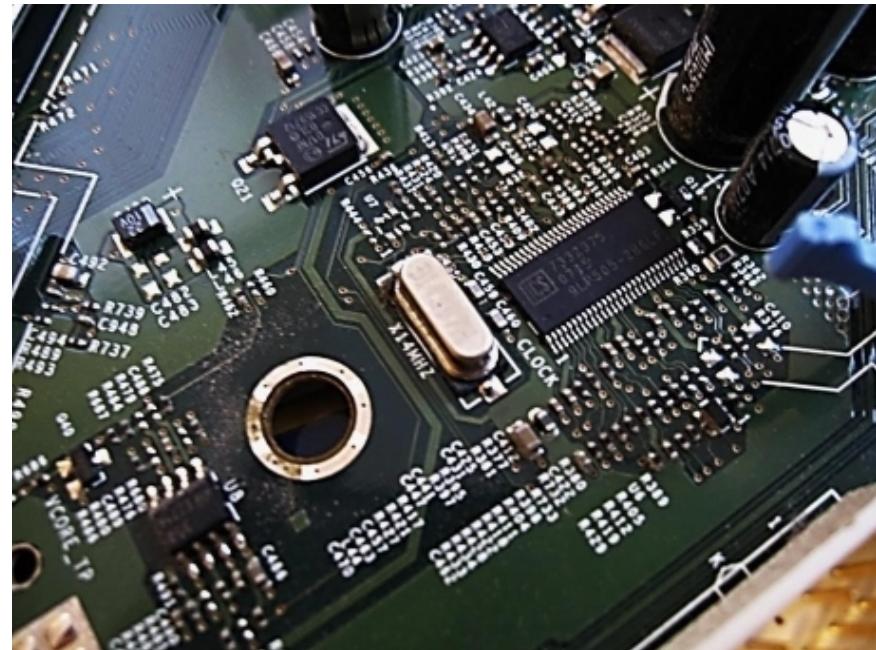
- It is used to enhance performance of the CPU where multiple pieces of code would be executing simultaneously on each pipelines.
- To an operating system, a single CPU with hyper threading performs as though there are two CPUs.



## 2.3 CPU - Advanced Features

### Speed measurement : clock speed

- The power of a CPU is measured by the speed and the amount of data that it can process.
- The speed of a CPU is rated in cycles per second. Example MHz, GHz.
- The amount of data that a CPU can process at one time depends on the size of the processor data bus (FSB) or the system crystal.



# 2.3 CPU - Advanced Features

## Overclocking

- Makes processor to work at a faster speed than normal but can result damage to CPU.

The screenshot shows the CPU-Z software interface with the following details:

**Processor**

- Name: Intel Core i5 4690K
- Code Name: Haswell
- Max TDP: 88 W
- Package: Socket 1150 LGA
- Technology: 22 nm
- Core Voltage: 1.279 V

**Specification**

- Intel(R) Core(TM) i5-4690K CPU @ 3.50GHz
- Family: 6
- Model: C
- Stepping: 3
- Ext. Family: 6
- Ext. Model: 3C
- Revision: C0

**Instructions**

- MMX, SSE, SSE2, SSE3, SSSE3, SSE4.1, SSE4.2, EM64T, VT-x, AES, AVX, AVX2, FMA3, TSX

**Clocks (Core #0)**

- Core Speed: 4698.90 MHz
- Multiplier: x 47.0 (8 - 47)
- Bus Speed: 99.98 MHz
- Rated FSB:

**Cache**

- L1 Data: 4 x 32 KBytes 8-way
- L1 Inst.: 4 x 32 KBytes 8-way
- Level 2: 4 x 256 KBytes 8-way
- Level 3: 6 MBytes 12-way

**Selection**: Processor #1

**Cores**: 4

**Threads**: 4

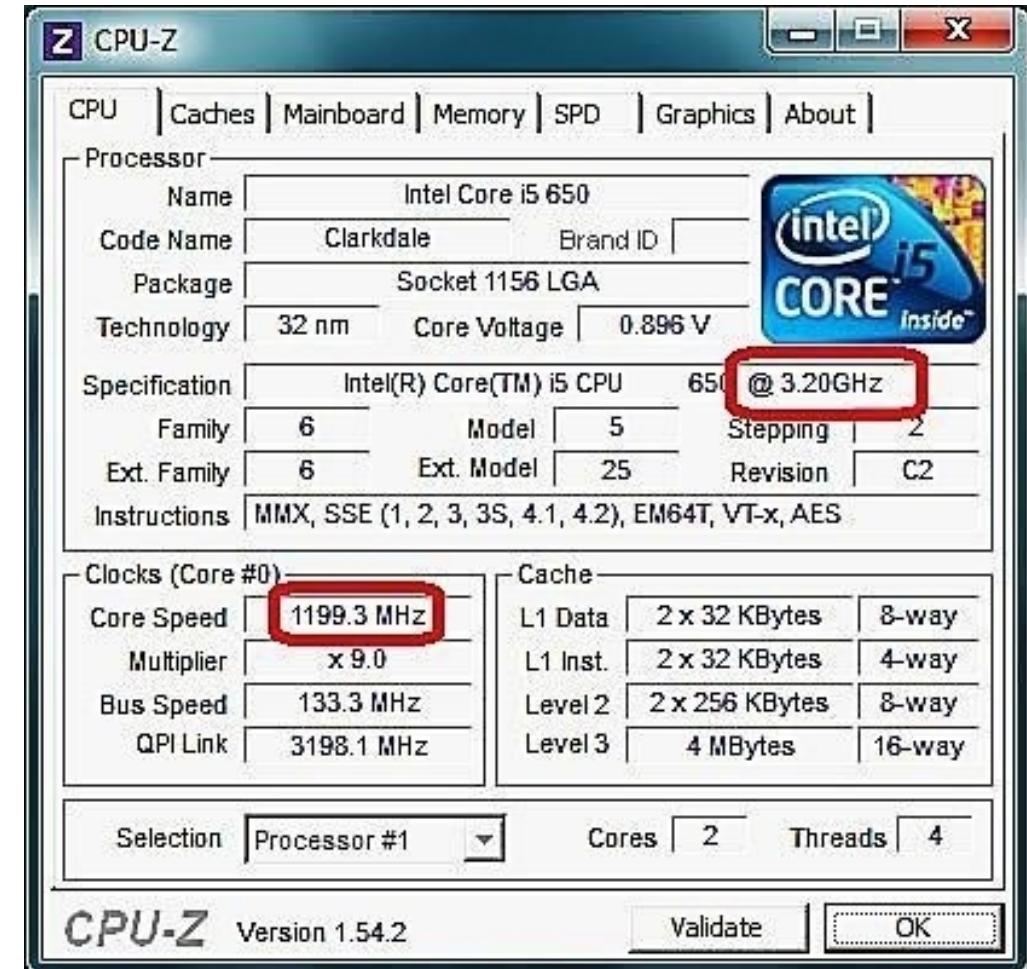
**CPU-Z** Ver. 1.70.0.x64 Tools Validate OK

## 2.3 CPU - Advanced Features

### CPU Throttling

- Processor runs at less than the rated speed to save power and produces less heat

Commonly used in Laptops and Mobile devices.

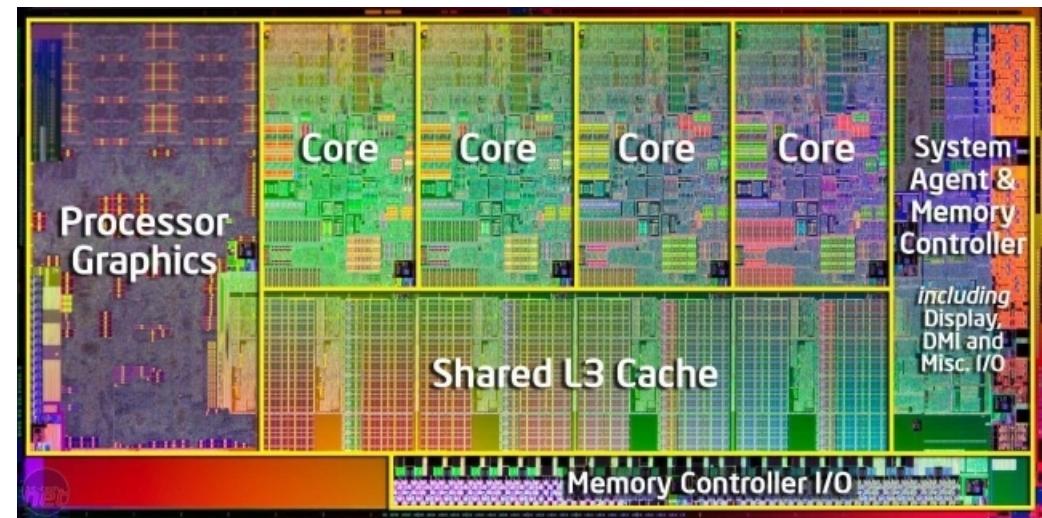
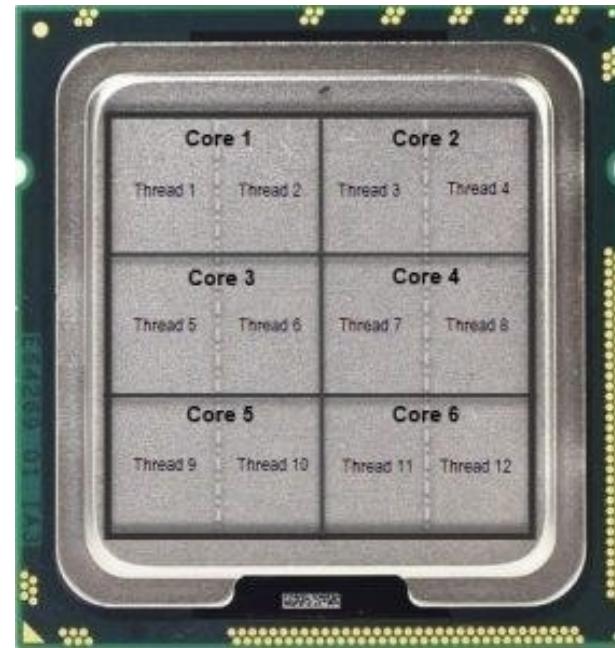


## 2.4 CPU - Cores

- A CPU contains one or more execution blocks which are known as core(s)
- More cores can execute more than one set of instructions simultaneously

### Type on the basis of cores

- **Single Core** - one core inside a single CPU that handles all the processing.
- **Dual Core** - Two cores and both can process information at same time.
- **Triple Core** - Quad-core with one processor disabled.
- **Quad Core** - Four cores and all can process information simultaneously.
- **Others** - Hexa, octa, deca and dodeca cores

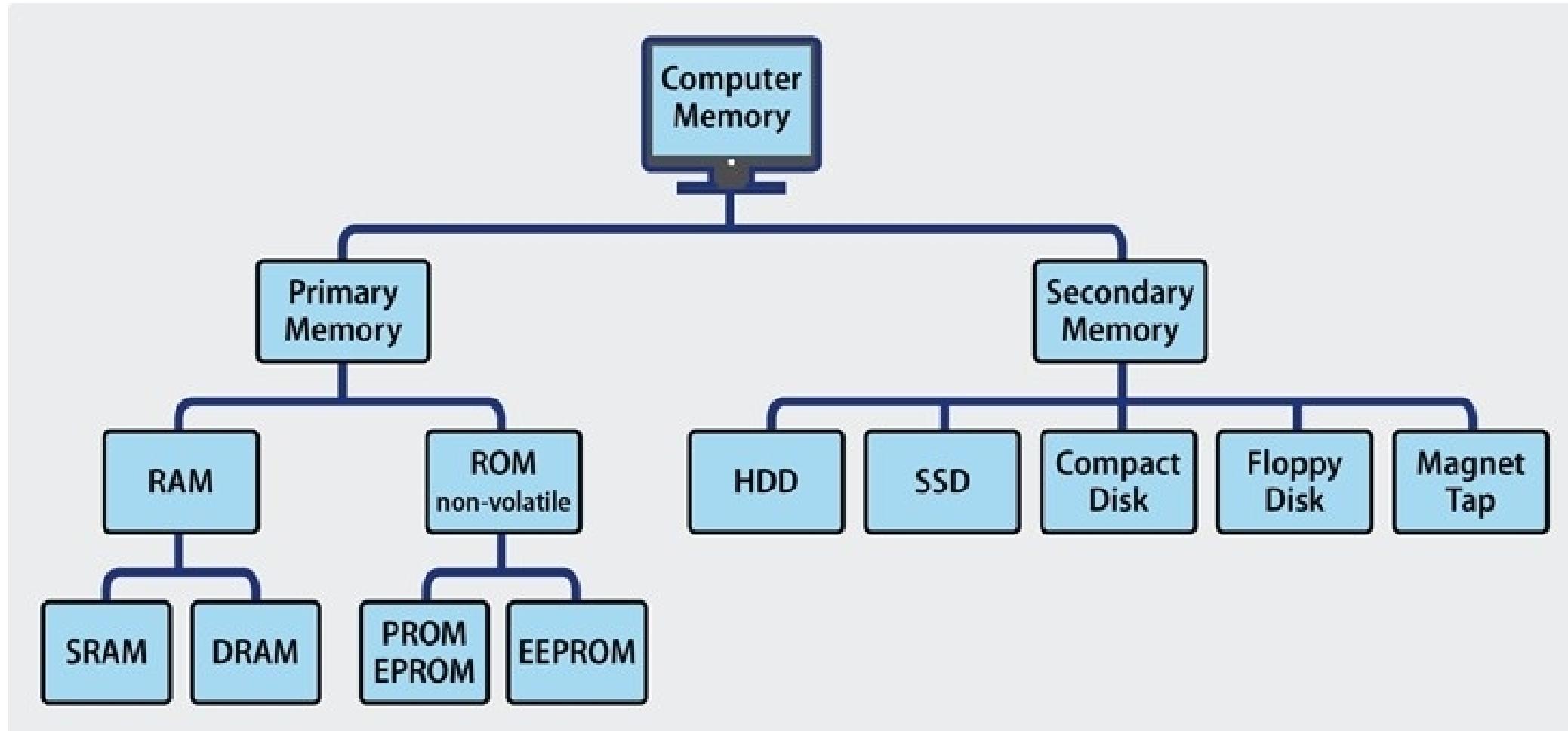


## 2.5 Internal Components : Cooling systems

- Electronic components generate heat which is caused by the flow of current within the components.
- **Case Fans** - It increases the air flow in the computer case to remove the heat generated inside.
- **CPU Fans** - A heat sink at bottom of CPU Fans draws heat from the core of the CPU and Fan moves it away.
- **Graphics Card Cooling System** - Fans are dedicated to cool the graphics-processing unit (GPU).
- Computers with extremely fast CPUs and GPUs may use a **water-cooling system** where a metal plate is placed over the processor and water is pumped over the top to collect the heat that the CPU creates.

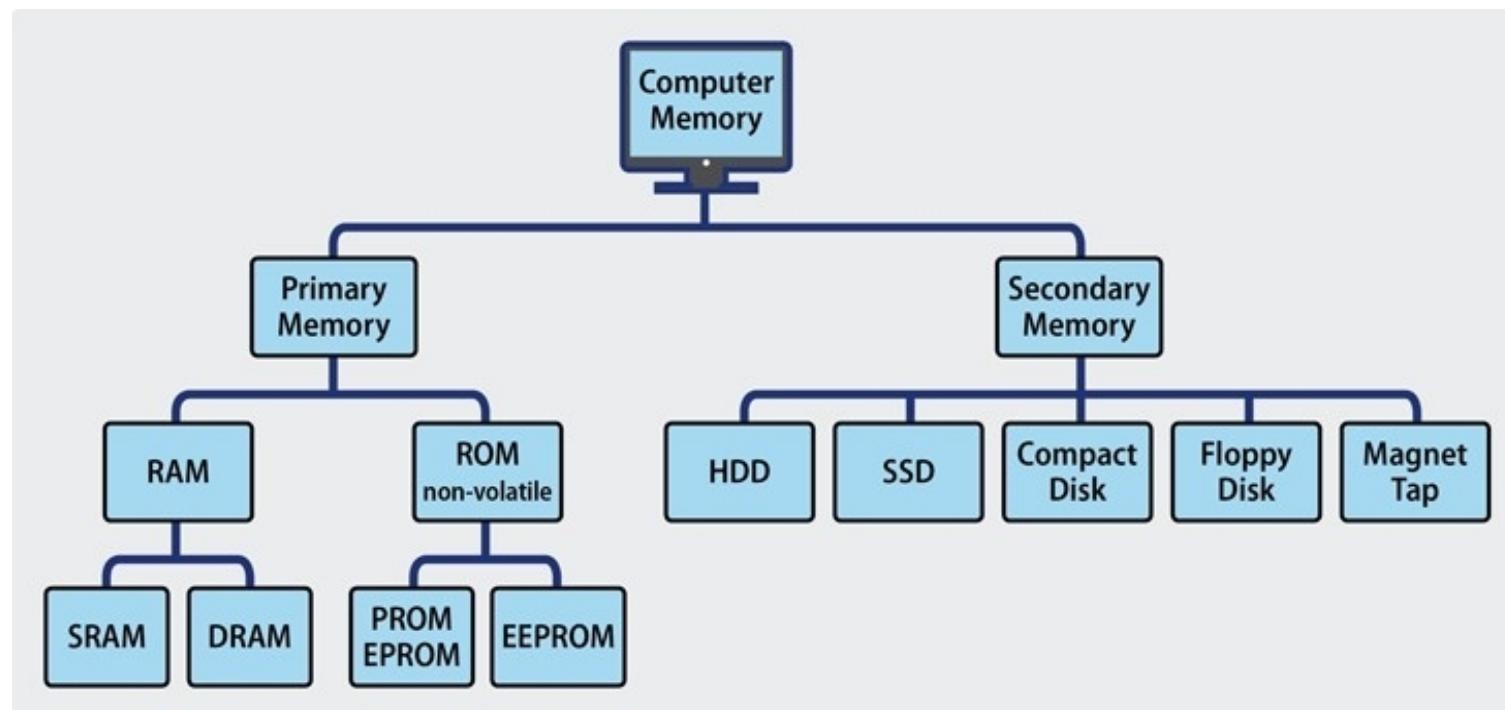


## 2.6 Internal Components : memory



## 2.6 Computer memory : Primary

- Directly accessed by the CPU
- Also known as primary memory
  - ROM - Read Only Memory
  - RAM - Read Access Memory
  - Cache memory
- RAM and cache are **volatile** while ROM is **non-volatile**



## 2.7 Primary memory : ROM

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### ROM (Read Only Memory)

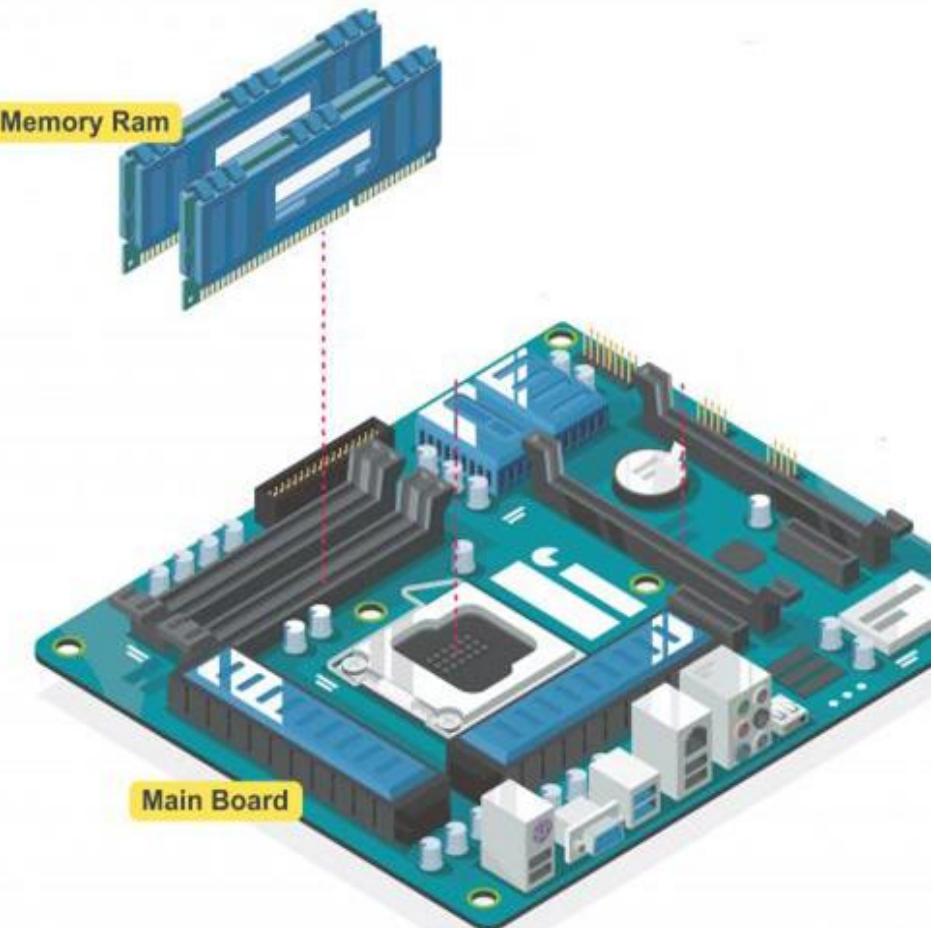
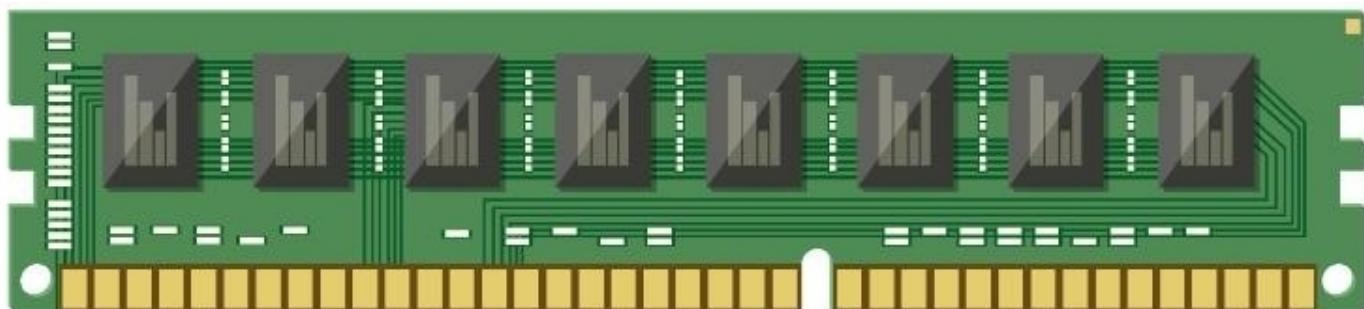
- It contains instructions that can be directly accessed by the CPU.
- ROM chips are **non-volatile** and are located on the motherboard.
- Basic instructions for booting the computer and loading the operating system are stored in ROM.
- Its contents can't be erased by normal means.
- **Types:** ROM, PROM, EPROM, EEPROM



## 2.8 Primary memory : RAM

### RAM (Random Access Memory)

- It is the temporary storage for data and programs that are being accessed by the CPU.
- The more RAM in a computer, the more capacity the computer has to hold and process large programs and files, as well as enhance system performance.
- Types: SRAM, DRAM, SDRAM, DDR (1,2,3 and 4) RAM

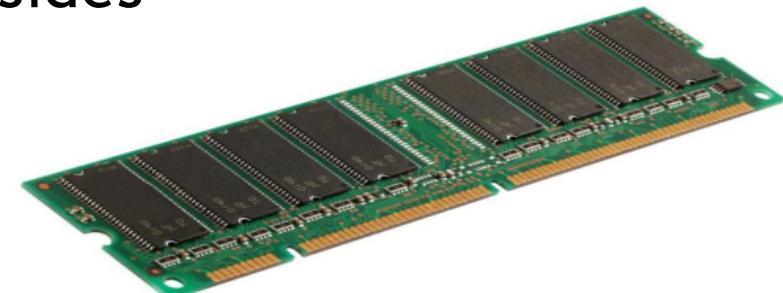
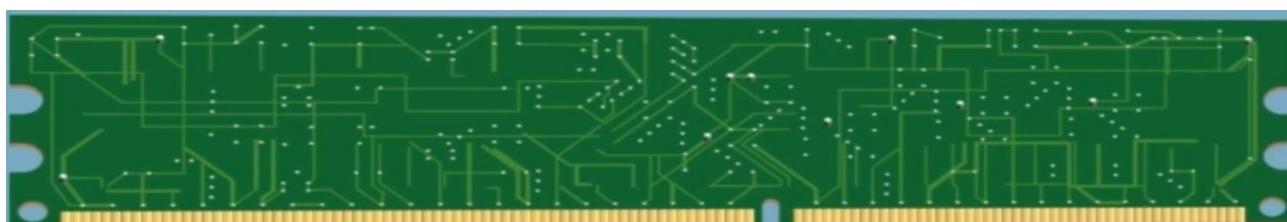
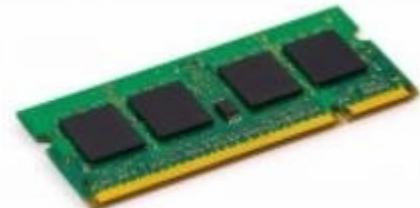


## 2.8 Primary memory : RAM

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### Memory Modules

- Today's memory modules are the special circuit board with memory chips on it.
- Types: **DIMM** (Dual Inline MM), **SODIMM** (Single Outline DIMM), **SIMM** (Single Inline MM)
- Single-sided memory modules only contain RAM on one side of the module.
- Double-sided memory modules contain RAM on both sides of the module.



## 2.8 Primary memory : RAM

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### Types of DRAM:

DRAM- Dynamic RAM

SDRAM- Synchronous Dynamic RAM

- DDR-SDRAM (Double Data Rate - Synchronous Dynamic RAM)
- DDR2-SDRAM
- DDR3-SDRAM
- DDR4-SDRAM
- DDR5-SDRAM

## 2.8 Primary memory : RAM

b. DDR - SDRAM

(184-pins)



c. DDR2 - SDRAM

(240-pins)



d. DDR3 - SDRAM

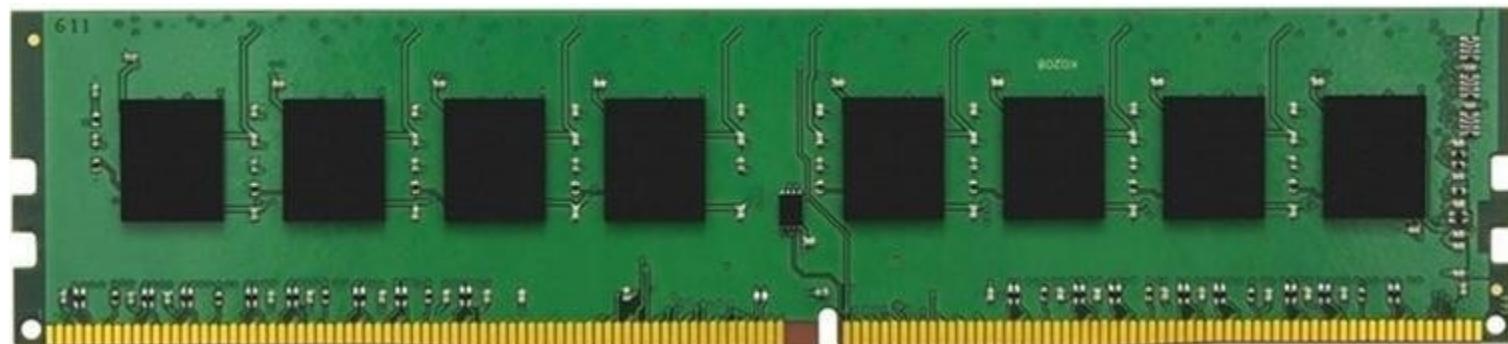
(240-pins)



## 2.8 Primary memory : RAM

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e. DDR4- SDRAM  
(288-pins)

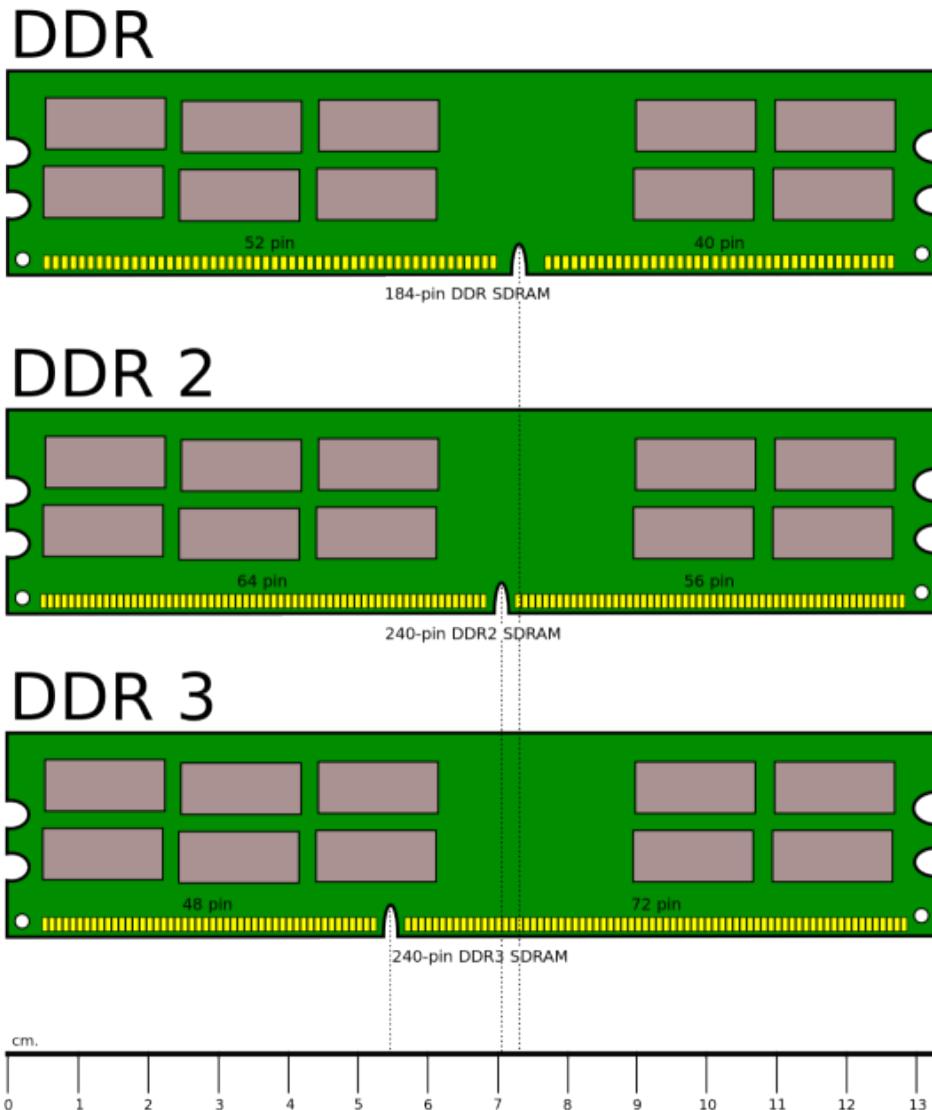


f. DDR5- SDRAM  
(288-pins)



## 2.8 Primary memory : RAM

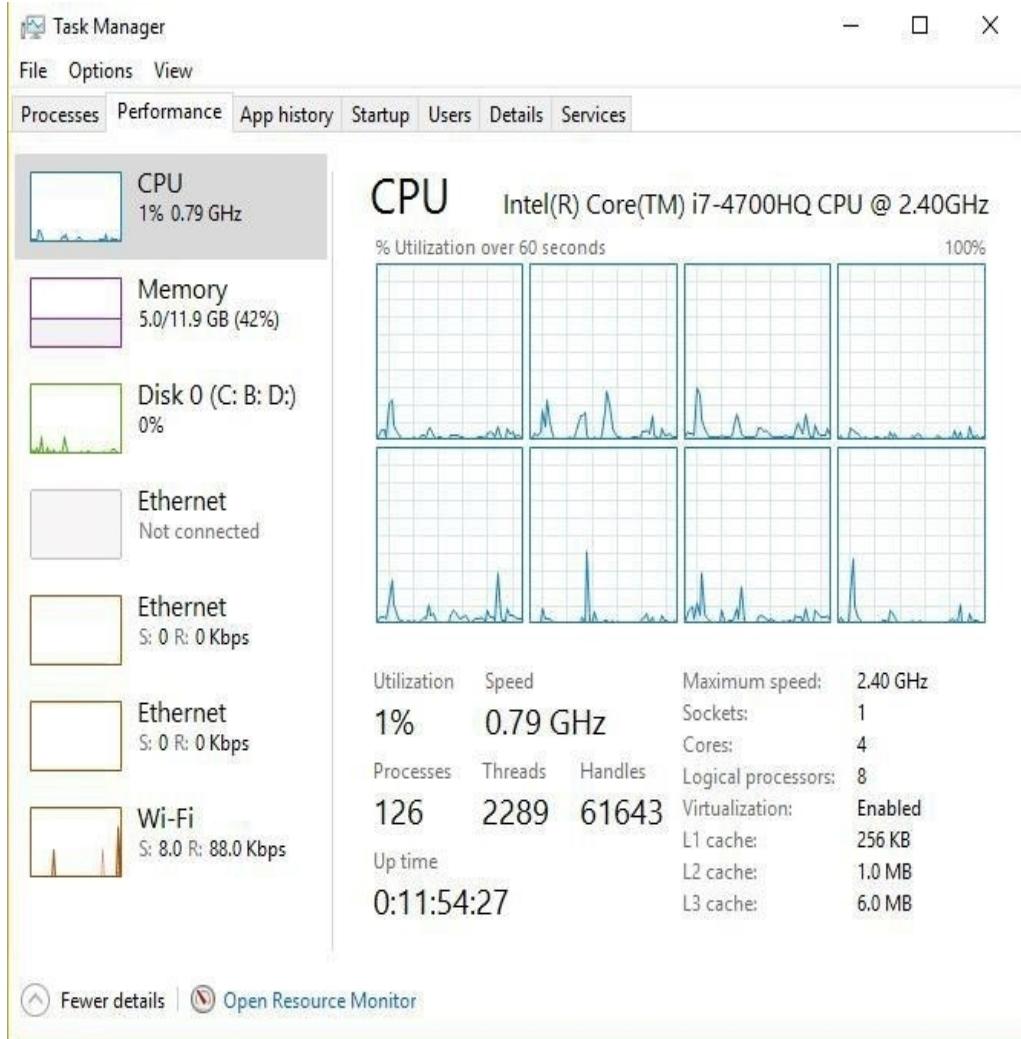
### Comparison



## 2.9 Primary memory : RAM

### Cache Memory

- **SRAM** is used as cache memory to store the most frequently used data and provides the processor with faster access to the data.
- Types: L1, L2, L3



## 2.10 Internal Components : Adapter cards

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- **Adapter cards** increase the functionality of a computer by adding controllers for specific devices or by replacing malfunctioning ports.
- **Example:** NIC, Wireless NIC, Sound and Video adapter, TV Tuner, Modem adapter, USB (Universal Serial Bus).
- **Redundant Array of Independent Disks (RAID) adapter**
  - Connects multiple hard drives to a computer to provide redundancy and to improve performance.



## 2.11 Motherboard Components : expansion slot

- Three types:-
  - PCI : Peripheral Component Interconnect
  - AGP : Advanced Graphics Port
  - PCIe : Peripheral Component Interconnect Express
- **PCI** : It is a 32-bit expansion slot and was used in most computers.



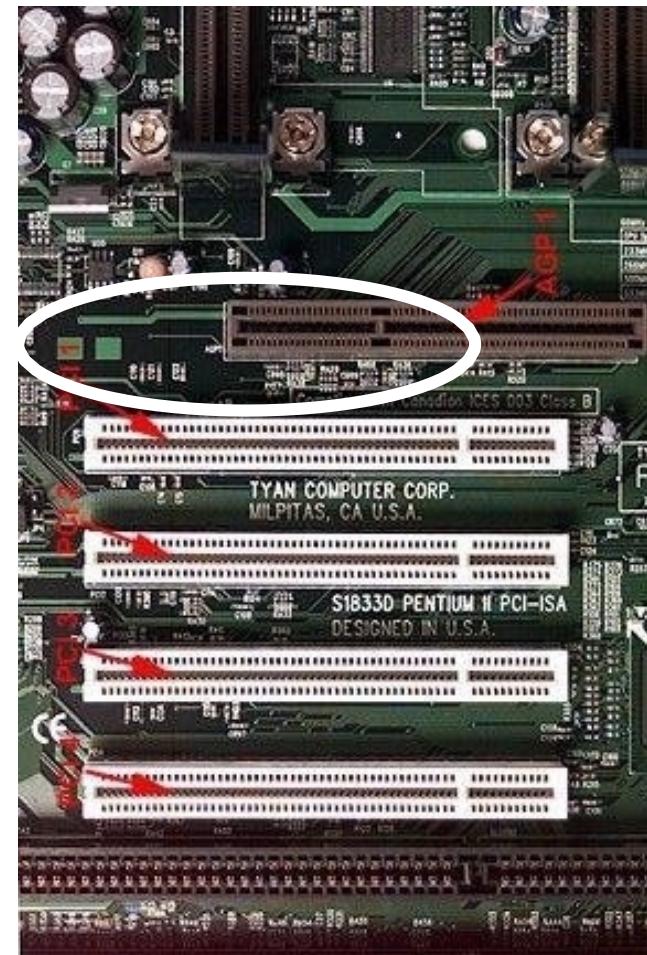
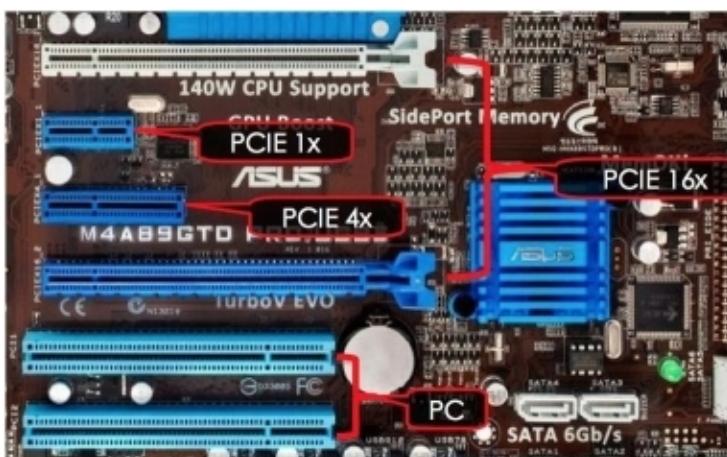
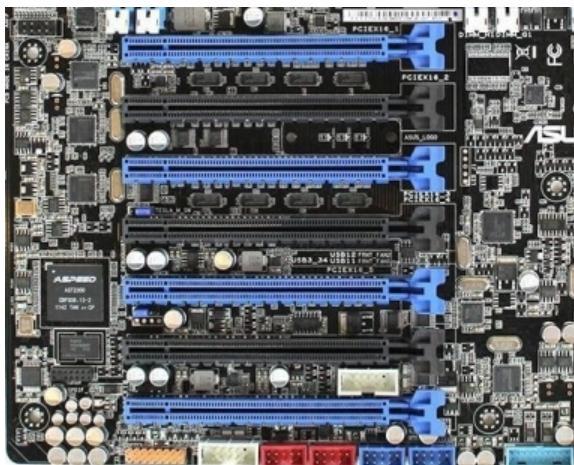
PCI Slots



PCI in a Motherboard

## 2.12 Motherboard Components : expansion slot

- **AGP (Advanced Graphic Port):** It is a 32-bit expansion slot and is designed for video adapters.
- **PCIe (PCI Express):** It is a serial bus expansion slot. It has replaced AGP as an expansion slot for video adapters and can be also used for other types of adapters.



## 2.13 Internal Components : storage drives

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### 6. Storage Drives

- Storage Drives read or write information to magnetic or chip based or optical storage media.
- The drive can be used to store data permanently or to retrieve information from a media disk.



#### Floppy Drive

- A floppy drive, or floppy disk drive, is a storage device that uses removable 3.5-inch floppy disks (5.25-inch is obsolete).
- Data Capacity - 720 KB or 2.44 MB.



## 2.14 Internal Components : storage drives

### 6. Storage Drives -Hard Drive

- A hard drive, or hard disk drive, is a magnetic storage device that is installed inside the computer.
- The hard drive is used as permanent storage for data.
- The storage capacity of a hard drive is measured in billions of bytes, or gigabytes (GB).
- The speed of a hard drive is measured in revolutions per minute (RPM).
- Multiple hard drives can be added to increase storage capacity.



## 2.14 Internal Components : storage drives

- Newer Hard Disk Drive are **SSDs (Solid State Drives)**.
- It uses far less energy than traditional magnetic drives.
- It has same form factor and uses ATA or SATA interfaces.
- Hence, can replace magnetic drives.

## End of Lecture for week 02

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Any question ?

